would be the total for 24 years of shipment operations. The radiological dose risk of accidents is the sum of the products of the probabilities (dimensionless) and consequences (in person-rem) of all potential transportation accidents. A radiological dose risk of 0.05 person-rem would result in much less than 1 (0.000026) latent cancer fatality in the exposed population. The radiological risk from accidents would include impacts from approximately 53,000 legal-weight truck shipments and 300 naval spent nuclear fuel rail shipments. The accident risk for legal-weight truck shipments would account for essentially all of the population dose and radiological impacts. Because DOE would not build a branch rail line to the repository under this scenario, the accident risk for rail shipments of naval spent nuclear fuel includes risks from accidents that could occur during intermodal transfers from railcars to heavy-haul trucks and during heavy-haul transportation in Nevada. Section 6.3.3 provides additional information on heavy-haul truck implementing alternatives for transporting rail casks in Nevada.

Consequences of Maximum Reasonably Foreseeable Accident Scenarios. The analysis evaluated the impacts of a maximum reasonably foreseeable accident scenario presented in Section 6.2.4.2.

Impacts from Traffic Accidents. In Nevada, less than 1 (0.49) fatality from traffic accidents would be likely during the course of transporting spent nuclear fuel and high-level radioactive waste under the mostly legal-weight truck transportation scenario. This estimate includes traffic fatalities involving escort vehicles.

MAXIMUM REASONABLY FORESEEABLE ACCIDENT SCENARIOS IN NEVADA

Maximum reasonably foreseeable accident scenarios analyzed for transportation in Nevada were the same as maximum reasonably foreseeable accident scenarios analyzed in Section 6.2.4.2 for national transportation. That is, the EIS analysis assumed that an accident determined to be reasonably foreseeable for national transportation could occur in Nevada. Because the distances traveled in Nevada would be much less than the total national travel to deliver spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site, the likelihoods of these accident scenarios occurring in the State would be less than those for the rest of the Nation. The likelihoods of two of these accident scenarios occurring in national travel are reported in Section 6.2.4.2.

6.3.2 IMPACTS OF NEVADA RAIL TRANSPORTATION IMPLEMENTING ALTERNATIVES

This section describes the analysis of human health and safety and environmental impacts for five rail transportation implementing alternatives, each of which would use a newly constructed branch rail line in Nevada to transport spent nuclear fuel and high-level radioactive waste to the repository. The branch line would transport railcars carrying large shipping casks from a mainline railroad to the repository (loaded) and back (empty). DOE has identified five 400-meter (0.25-mile)-wide corridors of land—Caliente, Carlin, Caliente-Chalk Mountain, Jean, and Valley Modified—for the possible construction and operation of the branch line (Figure 6-14). Chapter 2, Section 2.1.3.3.2 describes the corridors. Chapter 3, Section 3.2.2.1, discusses their affected environments.

Appendix J, Section J.3.1.2, contains additional information on the characteristics of possible variations of each corridor. Figure 6-14 shows these variations. Section 6.3.2.1 discusses impacts that would be common among the five possible corridors, and Section 6.3.2.2 discusses impacts that would be unique for each corridor.

DOE identified the five rail corridors through a process of screening the potential rail corridors it had studied in past years.

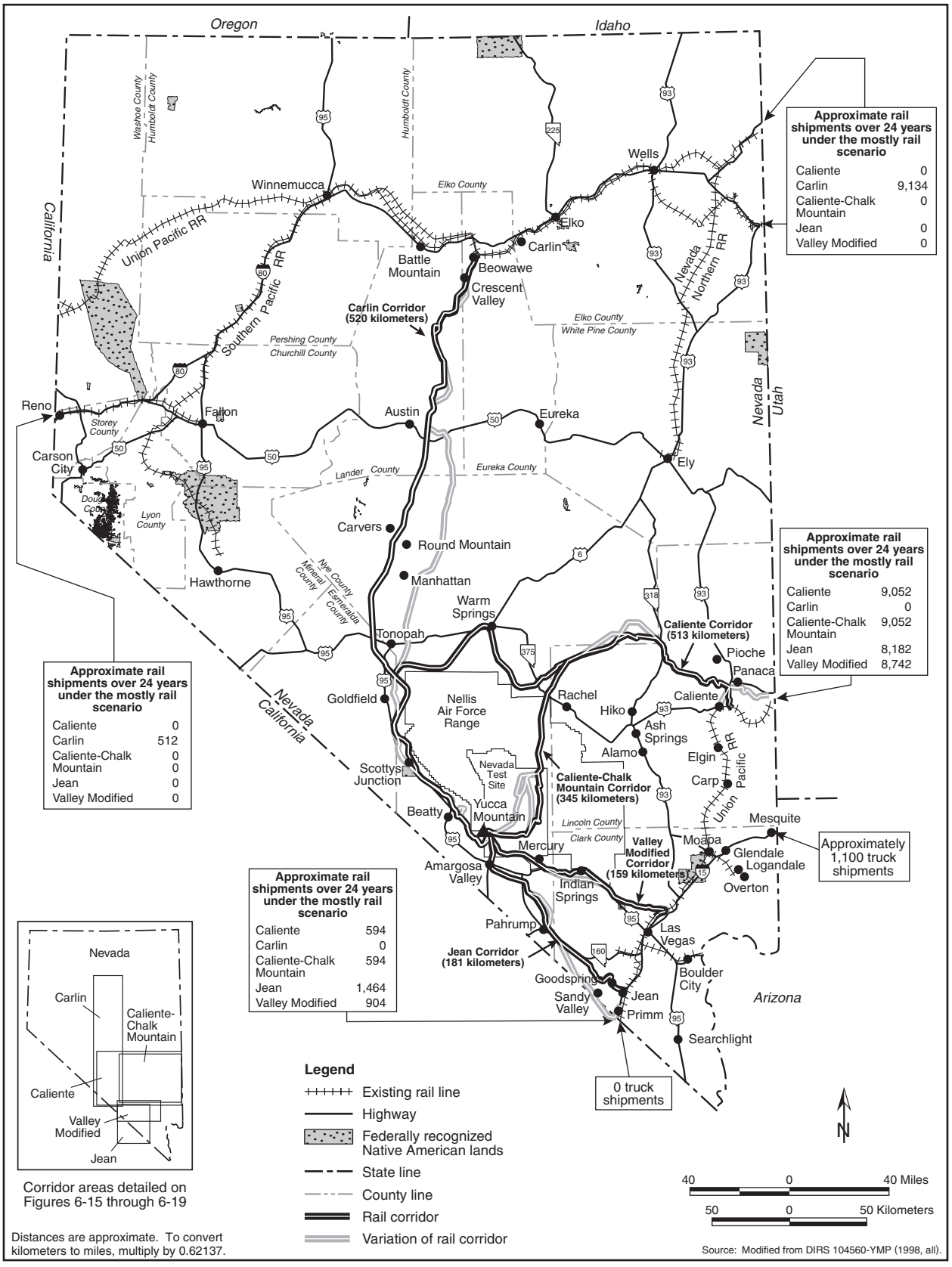


Figure 6-14. Potential Nevada rail routes to Yucca Mountain and estimated number of shipments for each route.

- The *Feasibility Study for Transportation Facilities to Nevada Test Site* study (DIRS 104777-Holmes & Narver 1962, all) determined the technical and economic feasibility of constructing and operating a railroad from Las Vegas to Mercury.

- The *Preliminary Rail Access Study* (DIRS 104792-YMP 1990, all) identified 13 and evaluated 10 rail corridor options. This study recommended the Carlin, Caliente, and Jean Corridors for detailed evaluation.

- *The Nevada Railroad System: Physical, Operational, and Accident Characteristics* (DIRS 104735-YMP 1991, all) described the operational and physical characteristics of the current Nevada railroad system.

- The *High Speed Surface Transportation Between Las Vegas and the Nevada Test Site (NTS)* report (DIRS 104786-Cook 1994, all) explored the rationale for a potential high-speed rail corridor between Las Vegas and the Nevada Test Site to accommodate personnel.

- The *Nevada Potential Repository Preliminary Transportation Strategy, Study 1* (DIRS 104795-CRWMS M&O 1995, all), reevaluated 13 previously identified rail routes and evaluated a new route called the Valley Modified route. This study recommended four rail corridors for detailed evaluation—Caliente, Carlin, Jean, and Valley Modified corridors.

- The *Nevada Potential Repository Preliminary Transportation Strategy, Study 2* (DIRS 101214-CRWMS M&O 1996, all), further refined the analyses of potential rail corridors in Study 1.

Public comments submitted to DOE during hearings on the scope of this EIS resulted in the addition of a fifth potential rail corridor—Caliente/Chalk Mountain.

The analysis of impacts for the five Nevada rail transportation implementing alternatives assumed the mostly rail transportation scenario. Therefore, the analysis included the impacts of legal-weight truck transportation from six commercial sites that would not have the capability while operational to handle or load a large rail cask. About 1,079 legal-weight truck shipments over 24 years would enter Nevada and travel to the repository. These shipments would use the same transport routes and carry about the same amounts of spent nuclear fuel per shipment as those described for the mostly legal-weight truck scenario (Section 6.3.1).

The analysis evaluated impacts to land use and ownership; air quality; hydrology; biological resources and soils; cultural resources; occupational and public health and safety; socioeconomics; noise and vibration; aesthetics; utilities, energy, and materials; and waste management. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

6.3.2.1 Impacts Common to Nevada Branch Rail Line Implementing Alternatives

The estimated life-cycle cost of constructing and operating a branch rail line in Nevada would range from $283 million to $880 million (2001 dollars), depending on the corridor and variation. This section discusses impacts for the analysis areas listed above that would be common to all five branch rail line implementing alternatives. DOE evaluated these impacts as described in Section 6.3. The construction of the branch rail line would last between 40 and 46 months, depending on the rail corridor. Shipping operations in the rail corridor would begin at a mainline siding where railcars carrying casks of spent nuclear fuel and high-level radioactive waste would switch from the mainline to the branch line for transport to the repository, and railcars carrying empty casks from the repository would switch to the mainline for transport back to the commercial and DOE sites. These shipments would continue for 24 years. Section 6.3.2.2 discusses impacts specific to each rail implementing alternative.

6.3.2.1.1 *Common Rail Land-Use and Ownership Impacts*

In identifying the land potentially affected by a rail corridor, the analysis assumed a corridor width of 400 meters (1,300 feet, or about 0.25 mile). The purpose of the 400-meter width was to provide sufficient space for final alignment to route the rail line around sensitive land features or engineering obstacles. Actual construction and operation in the corridor would mostly require less than about 60 meters (200 feet) of the 400-meter width. Thus, at most, about 15 percent of the land in the corridor would be disturbed by construction. The analysis also assumed that as much as 3.6 square kilometers (890 acres) of land outside of the main disturbed area within the corridor would be disturbed during the construction of a branch rail line for construction roads and camps and other construction-related activities.

Each rail corridor has possible variations providing different land ownerships and projected disturbances, as described in Appendix J, Section J.3.1.2. These possible variations would make little difference in land-use impacts, which could be more or less than those described below.

The analysis indicates no conflicts with commercial use and no identified conflicts with scientific studies for any of the proposed corridors. At present, the public land in each corridor, with the exception of portions of the Caliente-Chalk Mountain Corridor, is open to mining and recreational use, as discussed in Chapter 3, Section 3.2.2.1.1.

The construction and operation of a branch rail line in any of the rail corridors would directly and indirectly affect private property. The Valley Modified Corridor would have the smallest range of private land affected, from 7.3 to 0.2 square kilometer (45 acres). The Carlin Corridor would have the largest, from 7.3 to 15 square kilometers (1,800 to 3,700 acres). Most of the private property in the Carlin Corridor is in the vicinity of Beowawe and Crescent Valley. The ownership of each parcel of affected private land would require that DOE negotiate use arrangements with owners. The division of private property parcels could affect the current and future use of the property. Each corridor contains lands associated with the Nevada Test Site and managed by DOE. The amount of land in each corridor varies from 5 square kilometers (1,200 acres) for the Carlin and Caliente Corridors to 38 square kilometers (9,400 acres) for the Caliente-Chalk Mountain Corridor. With the exception of the Caliente-Chalk Mountain Corridor, the corridors cross Nevada Test Site lands only at entry points to the repository site close to the perimeter of the property and would be unlikely to result in a change of current land use. The Caliente-Chalk Mountain Corridor would enter the northeast portion of the Test Site and pass generally through the center of the site. Although this corridor would not result in a change of ownership, it would alter the current use of the land in the vicinity of the rail corridor.

Each rail corridor, with the exception of the Jean Corridor, would cross a portion of the Nellis Air Force Range (also known as the Nevada Test and Training Range) under the management of the U.S. Air Force. Lands along the corridors managed by the Air Force range from none for the Jean Corridor to 22 square kilometers (5,400 acres) for the Caliente-Chalk Mountain Corridor. The Caliente-Chalk Mountain Corridor would enter Nellis Air Force Range lands along the northern boundary and cross approximately 52 kilometers (32 miles) of land used for Department of Defense training operations.

The U.S. Air Force has identified national security issues in relation to a Caliente-Chalk Mountain Corridor, citing interference with Nellis Air Force Range testing and training activities (DIRS 104887-Henderson 1997, all). In response to Air Force concerns, DOE regards this route as a “nonpreferred alternative.”

As of July 2001, the Nevada Public Utility Commission’s website listed 20 electric power generating facilities scheduled for construction in Nevada by 2004. Five of the 20 plants have received permits to proceed. Two of these are located in Storey County and Pershing County. Three are in Clark County—one in North Las Vegas and two for the same company in an industrial park at Apex. None is anticipated

to impact land use for the repository or the transportation routes. The remaining 15 sites are anticipated to begin construction through 2002. The rights-of-way associated with the new plants are likely to cross Bureau of Land Management land. Of the 20 plants proposed, 13 are scheduled for construction in Clark County. These are on private, public, and reservation lands. None of the 20 proposed power plants would be within 50 miles (80 kilometers) of the proposed repository at Yucca Mountain. In addition, none of the proposed plant locations would conflict with any of the proposed transportation route options. The transmission lines and natural gas utility rights-of-way for the proposed locations could cross potential transportation routes. Current documentation is not sufficient to determine the locations for the proposed transmission line and natural gas rights-of-way. Conflicts due to proposed power plant rights-of-way would predominantly be associated with the proposed rail corridors and would be similar to existing rights-of-way discussed later in this section.

Each corridor has areas the public uses and areas available for sale and transfer. Each corridor crosses some roads used to access recreation areas on State of Nevada and Federal lands that are outside the corridors. As a consequence, the proposed branch rail line could result in limited access to areas currently in use by the public. Similarly, because of the corridor interface with grazing lands and wildlife areas, a rail line could create a barrier to livestock movement. Impacts to wildlife are discussed later in this section. Each corridor crosses road, highway, or utility rights-of-way. The passage of a branch rail line through these areas could result in land-use conflicts that, in turn, could result in the transfer of lands in the rights-of-way to DOE or a renegotiation of rights-of-way.

Construction. DOE expects the potential impacts of construction to be greater than those during the operation of a rail corridor. If the repository was approved and a rail corridor was selected, the following impacts from the construction of a branch rail line could occur:

- Difficulty for cattle to access water if the corridor divided Bureau of Land Management grazing allotments. Disruption of ranch operations and livestock rotations. Livestock deaths along roads used during construction. Disruptions to use of access roads to grazing allotments which typically consist of two-track roads and crisscross many of the corridors.

- Effects to private property divided by a branch rail line if alternative access was not available or provided. Although DOE would mitigate construction activities through stringent construction practices, those practices could affect property use, especially if the property was inhabited.

- Effects to mining activities such as mine operations or exploration if access roads were temporarily blocked or altered. Divided mining claims, making development of a claim less profitable if access became a problem.

- Effects on access to recreational areas. Division of some Bureau of Land Management lands currently used for recreation, which could temporarily isolate sections of land from the general public. Less ease of access in areas where Federal and State recreation areas can be accessed by roads (including two-track roads) from Bureau lands. Alteration of the recreational experience for some users; for example, construction of a rail corridor close to Bureau lands set aside for primitive and semiprimitive recreational use would alter those experiences.

- Effects on rights-of-way. Construction through these areas would require an evaluation of the impact to the road or utility or use of the right-of-way. Alteration of the construction of current roads or utility lines. Alteration of above-ground utility lines to pass beneath the branch rail line through an underpass to enable continued access to the utilities for maintenance. Movement of overhead transmission towers and poles to accommodate the branch rail line. Use of bridges or underpasses across high-volume roads to preclude at-grade crossings. Use of fencing where increased public contact could occur.

DOE would consult with the Bureau of Land Management, U.S. Air Force, other affected agencies, and other DOE program operations on the Nevada Test Site to help ensure that the final alignment of a branch rail line avoided or mitigated potential land-use conflicts.

Operations. DOE expects the operation of a rail line to cause smaller impacts than would construction. If the repository was approved and a rail corridor was selected, the following impacts of the operation of a branch rail line could occur:

- Division of some grazing lands. The Bureau of Land Management has stated that dividing grazing lands would result in a small loss of animal-unit months in large allotments, but would probably not affect ranch operations as long as there was available access across the corridor. (An *animal-unit month* represents enough dry forage for one mature cow for one month.) The loss of animal-unit months could affect the permittee's operation. In addition, the Bureau indicated that, if a branch rail line divided an allotment into separate pastures, an opportunity to rotate pasture use and thereby enable new grazing management options could be beneficial to livestock and vegetation. The Bureau acknowledges that fencing could be required along corridors where there are grazing allotments and that livestock could be isolated from water. Under these circumstances, water would have to be hauled to livestock or supplied in some other manner. In relation to branch rail line operations, train and track inspection and maintenance activities would be confined to areas disturbed by construction activities, so no additional disturbances would occur.

- No additional impacts to land use as long as there was property accessibility.

- No effects on mining activities over the long term. Effects on mining exploration if access to leases was blocked or restricted, but current mining operations probably would remain accessible.

- Effects to access to recreational areas. Division of Bureau of Land Management lands currently used for recreation and for access to Federal and State lands, which could limit access to portions of those lands. Alteration of the recreational experience for some users; for example, operation of a rail corridor close to Bureau lands set aside for primitive and semiprimitive recreational use could alter those recreational experiences.

6.3.2.1.2 *Common Rail Air Quality Impacts*

Construction. The construction of a branch rail line would comply with all applicable air quality regulations and associated requirements in the construction permits. Construction activities would increase pollutant concentrations in the areas near the rail corridor or any of the variations described in subsequent sections. Fuel use by construction equipment would emit carbon monoxide, nitrogen dioxide, sulfur dioxide, and particulate matter with diameters of 10 micrometers or less (PM_{10}) and 2.5 micrometers or less ($PM_{2.5}$). Construction activities would also emit PM_{10} in the form of fugitive dust from excavation and truck traffic. The emissions would be temporary and would cover a very large area as construction moved along the length of the corridor.

No air quality impacts would be unique to the branch rail line implementing alternatives with the exception of the Valley Modified Corridor, as described in Section 6.3.2.2.5.

Operations. Fuel use by diesel train engines would emit carbon monoxide, nitrogen dioxide, PM_{10}, and $PM_{2.5}$. Based on the Federal standards for locomotives (40 CFR 92.005), there are no emission standards for sulfur dioxide.

DOE conducted a conformity review using the guidance in DIRS 155566-DOE (2000, all) for the transportation activities of the Nevada rail implementing alternatives. The Las Vegas air basin is in

nonattainment status for carbon monoxide, which is largely a result of vehicle emissions (DIRS 156706-Clark County 2000, Appendix A, Table 1-3). The review determined that during the construction phase carbon monoxide emissions from the transportation of employees, materials, and supplies and from engine exhaust of construction vehicles working on the Valley Modified route could exceed the Clean Air Act General Conformity threshold level (about 110 to 160 percent of the threshold). These emission estimates represent about 0.1 to 0.2 percent of the 2000 daily carbon monoxide levels in the Las Vegas air basin. More detailed planning probably would result in emissions below the threshold. Emissions during the construction of all other routes and during repository operations would not exceed the carbon monoxide General Conformity threshold level in the nonattainment area.

The Las Vegas air basin is also in nonattainment status for PM_{10}, which is largely a result of dust from construction activities (DIRS 155557-Clark County 2001, Tables 3-8 and 5-3). The conformity review determined that PM_{10} emissions from the fugitive dust generated by Valley Modified route construction could exceed the General Conformity threshold level for PM_{10} (see Section 6.3.2.2.5.2). Additional dust control measures and construction planning in the nonattainment area could reduce the emissions to levels below the threshold. Emissions during the construction of all other routes and during the operation of any of those routes would not exceed the PM_{10} General Conformity threshold levels in the nonattainment area.

No air quality impacts would be unique to the branch rail line implementing alternatives with the exception of the Valley Modified Corridor, as described in Section 6.3.2.2.5.

6.3.2.1.3 *Common Rail Hydrology Impacts*

This section describes impacts to surface water and groundwater.

Surface Water

Construction. Construction-related impacts could involve the possible release and spread of contaminants by precipitation or intermittent runoff events or, for corridors near surface water, possible release to the surface water, the alteration of natural drainage patterns or runoff rates that could affect downgradient resources, and the need for dredging or filling of perennial or ephemeral streams.

Construction-related materials that could cause contamination would consist of petroleum products (fuels and lubricants) and coolants (antifreeze) necessary to support equipment operations. In addition, remote work camps would include some bulk storage of these materials, and supply trucks would routinely bring new materials and remove used materials (lubricants and coolants) from the construction sites. These activities would present some potential for spills and releases. Compliance with regulatory requirements on reporting and remediating spills and properly disposing of or recycling used materials would result in a low probability of spills. If a spill occurred, the potential for contamination to enter flowing surface water would present the greatest risk of a large migration of a contaminant before remediation took place. If there was no routinely flowing surface water (most areas along the corridors), released material would not travel far or affect critical resources before remediation occurred. During construction activities, water spraying would control dust and achieve soil compaction criteria, but water would not be used in quantities large enough to support surface-water flow and possible contaminant transport for any distance.

During construction, a contractor would move large amounts of soil and rock to develop the track platform (subgrade) and the access road. These construction activities could block storm drainage channels temporarily. However, the contractor would use standard engineering design and best management practices to place culverts, as appropriate, to move runoff water from one side of the track or road to the other. These culverts or other means of runoff control would be put in place early in the construction effort, because standing water in the work area would generally hinder progress.

Depending on site-specific conditions, construction could include regrading such that a number of minor drainage channels would collect in a single culvert, resulting in water flowing from a single location on the downstream side rather than across a broader area. This would cause some localized changes in drainage patterns but probably would occur only in areas where natural drainage channels are small.

All of the rail corridors would cross 100-year flood zones as identified on Flood Insurance Rate Maps published by the Federal Emergency Management Agency. None of the corridors has complete coverage (the percentage of the rail corridor included on the flood zone maps) on these maps due to large unstudied areas such as the Nellis Air Force Range and the Nevada Test Site, and areas with very limited coverage such as Lincoln County. For example, coverage by these flood maps ranges from about 10 percent for the Caliente-Chalk Mountain Corridor to about 90 percent for the Jean Corridor. However, the available information does provide an idea of corridor-specific flood zones, as summarized in the individual corridor discussions in Sections 6.3.2.2.1 to 6.3.2.2.5. In general, construction-related impacts associated with these flood zones would be very similar to those that could occur in any other identified drainage areas (that is, the alteration of natural drainage patterns and possible changes in erosion and sedimentation rates or locations). Construction in washes or other flood-prone areas probably would reduce the area through which floodwaters naturally flow. This could result in water building up, or ponding, on the upstream side of crossings during flood events, and then slowly draining through the culverts or bridges. Sedimentation would be likely on the upstream side of structures in such events and, accordingly, water going through the structure could be more prone to cause erosion once on the downstream side. Maintenance of a branch rail line would require periodic inspections of flood-prone areas (particularly after flood events) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the track bed would be repaired.

These alterations to natural drainage, sedimentation, and erosion would be unlikely to increase future flood damage, increase the impact of floods on human health and safety, or cause significant harm to the natural and beneficial values of the floodplains. Flood zone impacts would be minor primarily because of the relatively limited size of the disturbance that would be necessary to construct a branch rail line, and because the rail line design would accommodate a 100-year flood. In addition, the candidate rail corridors are in a region where flash flooding events are the primary concern. Though such flooding can be very violent and hazardous, it is generally focused in its extent and duration, limiting the potential for extensive impacts associated with the rail line. If DOE selected a rail corridor, it would initiate additional engineering and environmental studies and would perform additional National Environmental Policy Act reviews as a basis for final alignment selection and construction. DOE would then prepare a more detailed floodplain/wetlands assessment of the selected alternative.

Operations. The use of a completed branch rail line would have little impact on surface waters beyond the permanent drainage alterations from construction. The road and rail beds probably would have runoff rates different from those of the natural terrain but, given the relatively small size of the potentially affected areas in a single drainage system, there would be little impact on overall runoff quantities.

There would be no surface-water impacts unique to any of the branch rail line implementing alternatives with the exception of their relative proximity to surface-water resources.

Appendix L contains a floodplain/wetlands assessment that examines the effects of branch rail line construction, operation, and maintenance on the following floodplains in the vicinity of Yucca Mountain: Fortymile Wash, Busted Butte Wash, Drill Hole Wash, and Midway Valley Wash (see Section L.4.1). There are no delineated wetlands at Yucca Mountain. This section on common impacts and the following section on corridor-specific impacts address, in general terms, the flood zones along the rail corridors outside the immediate vicinity of Yucca Mountain. Appendix L, Section L.3.2, contains additional information on these portions of the corridors.

Groundwater

Construction. Potential groundwater impacts from rail line construction could include changes to infiltration rates, new sources of contamination that could migrate to groundwater, and depletion of groundwater resources resulting from increased demand. However, the potential for impacts would be spread over a large geographic area, so the probability would be low for a resource in a single area to receive adverse impacts. The above discussion of impacts to surface water identifies potential contaminants that branch rail line construction could release. These contaminants would be the same for groundwater.

Construction activities would disturb and loosen the ground, which could produce greater infiltration rates. However, this situation would be short-lived as the access road and railbed materials became compacted and less porous. In either case, localized changes in infiltration probably would cause no noticeable change in the amount of recharge in the area.

The analysis assumed that a number of wells would be required to support construction and that they would be installed along the rail corridor. It also assumed a 1-year period for construction activities in the vicinity of each well. Water withdrawal from these wells would not contribute to the depletion of a particular groundwater basin for two reasons: (1) the demand would be relatively short-term because it would stop when construction was complete, and (2) annual demands would be limited to a fraction of the perennial yields of the aquifers that would supply the water (see Chapter 3, Section 3.1.4). In addition, the Nevada State Engineer would approve water production from any well installed to support rail corridor construction. To grant approval, the State Engineer would have to determine that the short-term demand would not cause adverse impacts for other uses and users of the groundwater resource.

For the case in which water was obtained from a source other than a newly installed well and brought to the construction site by truck, water would be obtained from appropriated sources. That is, the water would be from allocations that the Nevada State Engineer had previously determined did not adversely affect groundwater resources.

Impacts on groundwater would differ among the implementing alternatives. These impacts, which Section 6.3.2.2 describes for the implementing alternatives, would include the projected water needs to support the construction of each candidate rail corridor and the estimated number of wells DOE would install along each corridor to meet that need.

Operations. The use of a completed railway corridor would have little impact on groundwater resources. There would be no continued need for water along the corridor, and possible changes to recharge, if any, would be the same as those at the completion of construction.

6.3.2.1.4 *Common Rail Biological Resources and Soils Impacts*

Construction. Construction activities would generally disturb no more than about 15 percent of the land inside a 400-meter (0.25-mile)-wide corridor. Vegetation would be cleared in an area generally less than 60 meters (200 feet) wide in the corridor to enable the construction of a branch rail line and a parallel access road. Vegetation would also be cleared from borrow areas and covered in disposal areas for excavated materials. Land for construction camps and in small areas where wells would be drilled would also be cleared of vegetation. Clearing vegetation and disturbing the soil would create habitat for colonization by exotic plant species present along a corridor. This could result in an increase in abundance of exotic species along the corridor, which could result in suppression of native species and increased fuel loads for fire. Reclamation of disturbed areas would enhance the recovery of native vegetation and reduce colonization by exotic species.

Impacts to biological resources from the construction of a branch rail line would occur due to a loss of habitat for some terrestrial species. Individuals of some species would be displaced or killed by construction activities. After the selection of a rail corridor, DOE would perform preconstruction surveys of potentially disturbed areas to identify and locate special status species that would need to be protected during construction.

Construction could affect the following biological resources:

- *Game and Game Habitat and Wild Horses and Burros.* Each candidate rail corridor or its variations would cross or be near [within 5 kilometers (3 miles)] several areas the Bureau of Land Management and the Nevada Division of Wildlife have designated as game habitat or wild horse and burro management areas (DIRS 104593-CRWMS M&O 1999, pp. 3-23 to 3-32). Construction activities in these areas would result in a loss of some habitat. Each rail corridor has the potential to disrupt movement patterns of game animals and wild horses and burros. The design of fences, if built along a rail corridor, would accommodate the movement of these animals. Large animals including game species (elk, bighorn sheep, mule deer, etc.), wild horses, and burros probably would avoid contact with humans at construction locations and would temporarily move to other areas during construction. Larger game animals occupy large home ranges and could easily traverse the distance between their designated habitat and a proposed corridor. Construction activities probably would disturb individuals or groups of animals and they would avoid the areas where construction was occurring. Fencing of the rail line could disrupt movements of horses, burros, and game animals, but the branch rail line would be designed to accommodate animal movement, to the extent possible, with such features as underpasses to enable large animals to cross from one side to the other. In the absence of fencing, movements of large animals would not be disrupted by the long-term presence of a rail line, but the possibility of trains colliding with game animals would be greater.

- *Special Status Species.* The construction of a branch rail line in any of the five rail corridors or their variations would involve the loss of varying amounts [3 to 11 square kilometers (740 to 2,700 acres)] of desert tortoise habitat. None of the corridors cross areas designated by the Fish and Wildlife Service as critical desert tortoise habitat (50 CFR 17.95). The abundance of tortoises varies from very low to medium along the proposed corridors (DIRS 101840-Karl 1980, pp. 75 to 87; DIRS 103281-Karl 1981, pp. 76 to 92; DIRS 101914-Rautenstrauch and O'Farrell 1998, pp. 407 to 411), but some desert tortoise deaths could occur during land-clearing operations. Numerous special status species occur along each of the proposed branch rail lines. Construction of a branch rail line could lead to habitat loss and fragmentation for the special status species, as well as to mortality of individuals.

- *Wetlands and Riparian Areas.* Each corridor could affect wetlands, springs, and riparian areas (DIRS 104593-CRWMS M&O 1999, pp. 3-23 to 3-32). These areas are generally important for biological resources and typically have high biodiversity. Potential impacts to these areas include destruction, alteration, or fragmentation of habitat; increased siltation in streams during construction; changes in stream flow; and loss of biodiversity.

- *Prime Farmland.* DOE identified no prime farmland for any corridor or route.

Section 6.3.2.2 describes the impacts to biological resources that would be unique for each corridor.

All of the candidate rail corridors and their variations would cross perennial or ephemeral streams that could be classified as jurisdictional waters of the United States. Section 404 of the Clean Water Act regulates discharges of dredged or fill material into such waters. After the selection of a rail corridor, DOE would identify any jurisdictional waters of the United States that the construction of a rail line would affect; develop a plan to avoid when possible, and otherwise minimize, impacts to those waters;

and, as applicable, obtain an individual or regional permit from the U.S. Army Corps of Engineers for the discharge of dredged or fill material. By implementing the plan and complying with other permit requirements, DOE would ensure that impacts to waters of the United States would be small.

The general design criteria for a branch rail line would include a requirement that a 100-year flood would not inundate the rails at channels fed by sizable drainage areas. During the operation and monitoring phase of the repository, conditions more intense than those that would generate a 100-year storm could occur in the area. Such conditions, depending on their intensity, could wash out access roads and possibly even the rail line. Although DOE would have to repair these structures, there is no reason to believe that such an occurrence would unduly affect area resources. If necessary, a permit would be obtained from the U.S. Army Corps of Engineers for discharge of dredge and fill material to repair the rail line. There would be no contamination that floodwaters could spread and, with the exception of areas of steep terrain, debris would not travel far. The operation of a branch rail line would stop during conditions that could lead to the flooding of track areas and would not resume until DOE had made necessary repairs.

Soil impacts from branch rail line construction would be primarily the direct impacts of land disturbance in the selected corridor. The amount of land disturbance, both inside and outside the corridor, would vary by corridor. The disturbed areas probably would be subject to an increase in erosion potential during construction. DOE would use dust suppression measures to reduce this potential. As construction proceeded, the railbed would be covered with ballast rock, which would virtually halt erosion from that area, and the access roads would be compacted, and gravelled, which would reduce erosion. As construction ended, disturbed areas (other than the railbed and access roads) would slowly recover. Other permanent erosion control systems would be installed as appropriate. Introduction of contaminants into the soil is also a potential concern. Proper control of hazardous materials during construction and prompt response to spills or releases would, however, reduce this concern. Impacts to soils would be limited to these areas disturbed and would be transitory and small.

Operations. Impacts to biological resources from shipments of spent nuclear fuel and high-level radioactive waste to the proposed repository along any of the five rail corridors, including their variations, would include periodic disturbances of wildlife from trains going by and from personnel servicing the corridor. Trains probably would kill individuals of some species.

Rail operations would not lead to additional habitat losses, although maintenance activities would prevent habitat recovery in the narrow band occupied by the branch rail line and access road. In addition, there could be loss of habitat due to inadvertent fires along the right-of-way from rolling equipment operations and maintenance activities. Although trains probably would kill individuals of some species, losses would be unlikely to affect regional populations of any species because all species are widespread geographically and trains would only use the corridor once or twice per day. Fewer individuals of large species would be likely to be killed during operations if the corridor was fenced, but fencing could restrict animal movement and disrupt migration patterns. Furthermore, fences would require continual surveillance to prevent individual animals or herds from becoming trapped. Nevertheless, the demographics of small herds could be adversely affected if individuals important to the viability of the herd were struck by a train. Fencing of the branch rail line and other features, such as tunnels (Jean Corridor), could lead to losses of individual animals or groups of animals. Individual animals could become caught inside fenced sections of the railroad and fail to find escape from oncoming trains. Game animals, horses, or burros could seek shelter in a tunnel and fail to escape if a train passed through.

Passing trains could disrupt wildlife, including game animals, horses, and burros, but such effects would be transitory. Noise from a train probably would disturb animals close to the track throughout operations, but this disturbance would diminish with distance from the track and over time as animals acclimated to daily disturbances from passing trains. The frequency of trains using the corridor (estimated to be 10 per

week, 5 in each direction) indicates that disturbance of animals near the rail line would probably be minimal. Noise from the trains could cause animals to move away from the tracks and, possibly, cause changes in migratory patterns.

Trains, and the presence of the branch rail line, could lead to the death of individual desert tortoises. DOE would consult with the Fish and Wildlife Service under Section 7 of the Endangered Species Act on means of mitigating the potential for losses, and would implement all terms and conditions required by the Fish and Wildlife Service.

No additional habitat loss would occur during operations, although the loss of habitat could become permanent if a long-term use for the rail line became viable after completion of the repository project and operations continued.

Impacts to soils from operation of the branch rail line would be small because train movement would not disturb soils and maintenance of the railbed and rails would involve minimal disturbance beyond that which had occurred during the construction of the rail line.

6.3.2.1.5 *Common Rail Cultural Resources Impacts*

Construction. Chapter 3, Section 3.2.2.1.5 lists the archaeological information currently available in each corridor that branch rail line construction could affect, including tables that list linear historic properties (for example, the Pony Express Trail) and sites listed on State of Nevada and national historic registers, respectively. DIRS 155826-Nickens and Hartwell (2001, all) contains more information about known and potential cultural resources along the candidate corridors and their variations. Direct impacts to these cultural resources (such as disturbing the sites or crushing artifacts) could occur from a variety of construction-related activities, including building the rail line and the right-of-way. In addition, rail line construction activities would include borrow areas, areas for the disposal of excavated material, construction camps, and access roads that would be outside the defined right-of-way. Because archaeological sites sometimes include buried components, ground-disturbing actions could uncover previously unidentified cultural materials. If cultural resources were encountered, a qualified archaeologist would participate in directing activities to ensure that the resources would be properly protected or the impact mitigated. DOE would use procedures to avoid or reduce direct impacts to cultural resources in construction areas where surface-disturbing activities would occur (see Chapter 9).

Indirect impacts, such as non-project-related disturbances of archaeological sites by purposeful or accidental actions of project employees, could occur from construction activities as a result of increased access and increased numbers of workers near cultural resource sites. These factors would increase the probability for either intentional or inadvertent indirect impacts to cultural resources. Section 6.3.2.2 discusses potential impacts specific to each corridor.

Systematic studies would be completed for a selected corridor to identify sites, resources, or areas that might hold traditional value for Native American peoples or communities. Two of the corridors (Caliente and Carlin) could affect as-yet unidentified resources because they could pass through the Timbisha Shoshone Trust Lands parcel near Scottys Junction. If sites or resources important to Native Americans were discovered in the future, either in or near an identified right-of-way, adverse effects could occur through direct means, such as construction activities, or indirectly through visual or auditory (sound and vibration) impacts.

In the viewpoint of Native Americans, the construction and operation of a branch rail line would constitute an intrusion on the holy lands of the Southern Paiute and Western Shoshone. In addition, some corridors pass through or near several significant places (see Chapter 3, Section 3.2.2.1.5). The American Indian Writers Subgroup has commented that the overall significance of these places and potential

impacts from operation of a rail line on them cannot be fully understood until DOE has identified the rail alignment and completed ethnographic field studies and consultations (DIRS 102043-AIWS 1998, p. 4-6). If DOE selected a rail corridor, it would initiate additional engineering and environmental studies (including cultural resource surveys), conduct consultations with Federal agencies, the State of Nevada, and tribal governments, and perform additional National Environmental Policy Act reviews as a basis for final alignment selection and construction. DOE would address the mitigation of potential impacts to archaeological and historic sites during the identification, evaluation, and treatment planning phases of the cultural resource surveys.

Operations. No additional direct or indirect impacts would be likely at archaeological and historic sites from the operation of a branch rail line. However, if Native Americans identified specific concerns during the preconstruction consultations described above, DOE would address them at that time.

6.3.2.1.6 *Common Rail Occupational and Public Health and Safety Impacts*

Incident-Free Transportation. Incident-free impacts of rail transportation in Nevada would be unique for each of the five Nevada rail transportation implementing alternatives; these are discussed for each implementing alternative in Section 6.3.2.2. Incident-free impacts to hypothetical maximally exposed individuals would be similar among the Nevada rail transportation implementing alternatives. Table 6-21 lists the impacts to hypothetical maximally exposed individuals in Nevada who would be exposed to all rail shipments along a branch rail line. Appendix J, Section J.1.3.2.2 describes assumptions for estimating doses to maximally exposed individuals along routes in Nevada.

Table 6-21. Estimated doses and radiological impacts to maximally exposed individuals for Nevada rail implementing alternatives.[a,b]

Individual	Dose (rem)	Probability of latent cancer fatality
Involved workers		
Inspector	34	0.012
Railyard crew member	4.2	0.002
Public		
Nevada resident along route (rail)[c]	0.002	0.0000008
Person in traffic jam (legal-weight truck)[d]	0.02	0.000008
Person at service station (legal-weight truck)[e]	0.08	0.00004
Resident near rail stop	0.29	0.0001

a. The assumed external dose rate is 10 millirem per hour at 2 meters (6.6 feet) from the vehicle for all shipments.
b. Totals for 24 years of operation.
c. This represents a Nevada resident approximately 30 meters (98 feet) from the branch rail line. See Appendix J, Section J.1.3.2.2.
d. Person in a traffic jam is assumed to be exposed one time only.
e. Assumes the person works at the service station for all 24 years of operations. Mitigation would be required to reduce doses to members of the public to below 100 millirem per year.

Accidents. Accident risks and maximum reasonably foreseeable accidents for rail shipments of spent nuclear fuel and high-level radioactive waste would be common to the Nevada rail transportation implementing alternatives. This section, therefore, discusses these risks.

Table 6-22 lists accident risks for transporting spent nuclear fuel and high-level radioactive waste in Nevada for the five Nevada rail transportation implementing alternatives. The data show that the risks, which are listed for 24 years of operations, would be low for each alternative. These risks include risks associated with transporting 1,079 legal-weight truck shipments made from the commercial sites that could not load rail casks while operational. Small variations in the risk values, principally evident for the Jean branch rail line, are a result of risks that would be associated with transporting rail casks arriving from the east on the Union Pacific Railroad's mainline through the Las Vegas metropolitan area. The values that would apply for a Valley Modified or Caliente-Chalk Mountain branch line would be lower

Table 6-22. Estimated health impacts[a] to the public from potential accident scenarios for Nevada rail implementing alternatives.

Risk	Caliente	Carlin	Caliente-Chalk Mountain	Jean	Valley Modified
Radiological accident risk[b]					
Dose risk (person-rem)	0.0017	0.0026	0.0017	0.0071	0.0021
LCFs[c]	0.0000009	0.0000013	0.0000009	0.000004	0.000001
Traffic fatalities	0.07	0.09	0.05	0.06	0.05

a. Data are reported for 24 years of operations.
b. In this table, radiological accident dose risk is the sum of the products of the probabilities (dimensionless) and consequences (in person-rem) of all potential transportation accidents. This sum is converted to latent cancer fatalities using the conversion factor of 0.0005 latent cancer fatality per person-rem.
c. LCF = latent cancer fatality.

because of a shorter corridor (Valley Modified), or a more remote and mid-length corridor (Caliente-Chalk Mountain).

Consequences of Maximum Reasonably Foreseeable Accidents. The national transportation analysis evaluated impacts of maximum reasonably foreseeable accidents (see Section 6.2.4.2).

6.3.2.1.7 *Common Rail Socioeconomics Impacts*

The common social and economic activities and changes associated with the construction of a branch rail line include:

- A period of brief, intense elevation in project-related employment followed by an abrupt decrease in associated employment opportunities as construction workers move to other projects.
- Transition of workers associated with construction of the branch rail line to other construction work in Nevada (if these workers did not move into positions associated with rail line operations).
- Population increases and then subsequent net declines as related employment requirements decline.
- A very slightly slower rate of growth in the level of employment as the economy moved from construction of a rail line to operations.
- A rise in the economic measures of real disposable income, Gross Regional Product, and State and local government expenditures during construction. Gross Regional Product, which is extremely sensitive to employment fluctuations, would be affected. Real disposable income, which consists of all forms of income including transfer payments (primarily unemployment compensation), is less responsive to changes in employment.

DOE performed detailed analyses for the corridors of the five branch rail line implementing alternatives. The results of these analyses, driven by the length of the corridor, are representative of the potential variations (options and alternates) of each corridor as listed in Appendix J, Section J.3.1.2. The lengths of the variations for each corridor are similar to the original corridor, as listed in Section 6.3.2.2.

Section 6.3.2.2 describes socioeconomic impacts for each particular implementing alternative.

6.3.2.1.8 *Common Rail Noise and Vibration Impacts*

Construction. For the most part, the rail corridors would pass through areas that are remote from human habitation. Thus, the potential for noise impacts from the construction of a branch rail line would be limited. Nonetheless, some people could be affected, including persons living near the corridor, using nearby recreational areas, seeking quiet and solitude at nearby locations, or living in nearby small rural communities. Noise from railroad construction could affect wild animals that inhabit the areas through which the corridors pass. However, construction noise would be transient and its sources would be gone when construction was complete.

Estimated noise levels for railroad construction would range from 62 to 74 A-weighted decibels (dBA) within 150 meters (500 feet) of the noise source and from 54 to 67 dBA at 600 meters (2,000 feet) (DIRS 104892-ICC 1992, p. 4-97). At distances up to 6 kilometers (3.7 miles), sound could exceed levels required for solitude (20 dBA). Trips to borrow and spoil areas would be another source of noise. Rail line construction would occur primarily during daylight hours, so nighttime noise would not be an issue unless there was a need to use accelerated construction to meet schedule constraints. There is a possibility that the construction of some structures associated with the rail line would occur during hours not in the normal workday, but the frequency and associated noise levels would be unlikely to be great. Because construction would progress along a corridor, construction noise would be transient in nearby communities. Noise levels could approach generally accepted limits for some residential and commercial areas, but this would be for a brief time. Because there are no permanent residences, construction noise would not be an issue for activities inside the boundaries of the Nellis Air Force Range, the Nevada Test Site, or the land withdrawal area that DOE analyzed for the proposed repository. Occupational Health and Safety Administration regulations (29 CFR) establish hearing protection standards for workers. DOE would meet those standards for workers involved in building a branch rail line.

Ground vibration from the construction of engineered structures, such as bridge foundations, could be discernible in some areas. The areas that would be affected would be determined by engineering surveys and detailed alignment analyses conducted after the selection of a corridor.

Operations. About five rail round trips (10 one-way trips) of spent nuclear fuel, high-level radioactive waste, or other material would occur weekly for 24 years on the branch rail line during normal operations. Noise from these trains could affect the same group of individuals and animals as construction of the rail line. To estimate noise impacts, the analysis assumed that trains would travel as fast as 80 kilometers (50 miles) an hour. The equivalent-continuous (average) sound level at 2,000 meters (6,600 feet) from a train consisting of two locomotives and 10 cars traveling at 80 kilometers an hour would be 51 dBA (DIRS 148155-Hanson, Saurenman, and Towers 1998, pp. 1 to 8), which is near the nighttime standard for residential areas (50 dBA). The estimated noise level at 200 meters (660 feet) would be 62 dBA (DIRS 148155-Hanson, Saurenman, and Towers 1998, pp. 1 to 8). This is slightly higher than the daytime standard for residential communities. In isolated regions, few people would be affected. In addition, trains traveling through or near communities would normally operate at reduced speed, so their noise levels would be lower. The combination of sparse population in the vicinity of the rail corridors, remoteness of a branch rail line from populated areas, substantial diminishing of the level of train noise with distance, and infrequent passage of trains indicates that the potential for noise impacts would be low for any of the corridors. In addition, in areas where a branch rail line or a variation could pass near a community, DOE would limit operating speeds to the extent necessary to ensure safety and noise levels below those listed in accepted noise standards.

DOE is not aware of traditional cultural properties or other areas along the rail corridors or variations where noise from trains or construction of a branch rail line could interfere with conditions necessary for meditation by, or religious ceremonies of, Native Americans. Similarly, there are no known ruins or other culturally sensitive structures that ground vibration could affect.

Ground vibration from trains using a branch rail line to Yucca Mountain would have the potential to cause impacts (see Section 6.3). Sections 6.3.2.2.1 to 6.3.2.2.5 discuss specific issues related to vibration for each corridor.

DIRS 155939-Nelson (2000, Appendix F, Table 1, p. 4) discussed vibration criteria for protection of historic buildings and presented data on vibration (peak particle velocity) for unit coal trains. Unit coal trains can consist of many loaded coal cars (usually more than 100) and multiple locomotives. The data (DIRS 155939-Nelson 2000, Appendix F) show that at distances of 100 meters (330 feet) from the track and for track not specially selected to reduce vibration, vibration from trains traveling at 56 kilometers (35 miles) per hour would be below the criterion for preservation of historic structures. Vibration from trains traveling on track that does not have rolling-mill undulation falls below the criterion at distances as close as 10 meters (33 feet) and speeds as high as 80 kilometers (50 miles) per hour. For shorter trains, such as those that would transport railcars with spent nuclear fuel and high-level radioactive waste to Yucca Mountain, attenuation of vibration with distance would be greater than that reported (DIRS 155939-Nelson 2000, p. 23).

6.3.2.1.9 *Common Rail Aesthetics Impacts*

Construction. The greatest impact on visual resources from the construction of a branch rail line would be the presence of workers, camps, vehicles, large earth-moving equipment, laydown yards, borrow areas, and dust generation. These activities, however, would have a limited duration (about 40 to 46 months depending on the corridor). The potential rail corridors and variations have all been affected to some extent by human activity, as described in Chapter 3, Section 3.2.2.1.1. Construction would progress along the selected corridor from its starting point to the proposed repository. Only a small portion of the overall construction time would be spent in one place; the exception to this would be places where major structures, such as bridges, would be built. In general, an individual construction camp would be active only for part of the construction period; after the completion of construction in an area, the camp would close.

Dust generation would be controlled by implementing best management practices such as misting or spraying disturbed areas. Construction activities would not exceed the criteria in the Bureau of Land Management Visual Resource Management guidelines (DIRS 101505-BLM 1986, all) with the exception of the Wilson Pass Option of the Jean Corridor. If the rail line crossed Class II lands, more stringent management and reclamation requirements would be necessary to retain as much as possible of the existing character of the landscape. The short duration of branch rail line construction activities, combined with the use of best management practices, would help mitigate the impacts of activities that could exceed the management requirements for Class II lands. Visual impacts to scenic quality Class C lands on the Nevada Test Site would not occur because of the remoteness and inaccessibility of the location. Impacts to the viewshed during construction of a branch rail line would include loss of vegetation in the areas surrounding the rail line. This loss could result in a long-term loss of viewshed along the corridor.

Operations. During proposed repository operations, visual impacts would be due to the existence of the branch rail line, access road, and borrow pits in the landscape and the passage of trains to and from the repository. The passage of 10 trains a week (5 coming and 5 returning) would have a small impact, temporarily attracting the attention of the casual observer. In limited access recreational areas classified as primitive or semiprimitive, the passage of these trains would have a greater impact. In addition, the noise generated by the trains would attract attention to them, temporarily increasing their impact on the scenic quality of the landscape. There would be no aesthetic impacts unique to any of the rail implementing alternatives.

6.3.2.1.10 *Common Rail Utilities, Energy, and Materials Impacts*

Construction. Because all five corridors would pass through sparsely populated areas with little access to support services, portable generators would provide electricity to support construction activities. The total fossil-fuel consumption in Nevada was about 3.8 billion liters (1 billion gallons) in 1996 (DIRS 148094-BTS 1997, Table MF-21). Fuel consumption estimates for construction of a branch rail line indicate low impacts compared to the statewide consumption of petroleum fuel.

Steel for rails and concrete, principally for rail ties, bridges, and drainage structures, and rock for ballast would be the primary materials consumed in the construction of a branch rail line. DOE would buy precast concrete railbed ties, culverts, bridge beams, and overpass components from a number of suppliers. Actual onsite pouring of concrete [less than 120,000 metric tons (132,000 tons)] would account for less than 30 percent of the total mass of concrete, which would be less than 0.5 percent of the concrete use in Nevada in 1998 (DIRS 104926-Bauhaus 1998, all). Because DOE would buy precast concrete components from suppliers and because onsite concrete construction would involve a small amount of material for some abutments, the localized impact of concrete use in rail corridor construction would not be great for any of the corridors.

Because sources for rails and railroad ties are well established in the southwest and nationally, none of the quantities of materials required for constructing a rail line in Nevada would create demand or supply impacts in southern Nevada (DIRS 105033-Zocher 1998, all).

Impacts on utilities, energy, and materials differ among the implementing alternatives, as described in Section 6.3.2.2.

Operations. Impacts to utilities, energy, and materials from the operation of a branch rail line in Nevada would be small. Use of fossil fuel for train operations would be small. Chapter 10 discusses fossil fuel used for rail operations. No impacts would be unique to any of the branch rail line implementing alternatives.

6.3.2.1.11 *Common Rail Waste Management Impacts*

Construction. The construction of a branch rail line would require materials such as rail ties and steel; rock ballast; concrete; oils, lubricants, and coolants for heavy machinery; and compressed gasses (hazardous materials) for welding. DOE could order construction materials in correct sizes and number, resulting in very small amounts of waste (DIRS 152540-Hoganson 2000, all). In addition, much of the residual material from rail line construction would be saved for reuse or recycled. Construction of the branch rail line, service road, and access roads would require land clearing. Excavated soil would be used for fill as much as possible. Vegetation would be disposed of in accordance with State of Nevada requirements. Construction in any of the five corridors would result in small amounts of waste that would require disposal. Wastes would consist of construction debris such as banding material that bound ties and rails (DIRS 152540-Hoganson 2000, all) that DOE would dispose of in permitted landfills. Hazardous waste such as lubricants and solvents, if any, would be shipped to a permitted hazardous waste treatment and disposal facility.

Sanitary solid waste and sanitary sewage from flush toilets and showers would be generated in construction camps. The estimated peak annual generation would be 940 metric tons (1,000 tons) of sanitary solid waste and 37 million liters (10 million gallons) of sanitary sewage. The solid waste would be disposed of in a permitted landfill. Nevada has 24 operating municipal solid waste landfills (DIRS 155564-NDEP 2001, p. 1) with a combined capacity to accept 11,000 metric tons (12,000 tons) of waste per day (DIRS 155563-NDEP 2001, landfill inventory). In 2000, approximately 3.5 million metric tons (3.9 million tons) of sanitary solid waste were disposed of in Nevada (DIRS 155565-NDEP 2001,

Section 2.1), so the construction camp waste would add approximately 0.03 percent. The sanitary sewage could be treated in an onsite treatment facility for which the contractor had obtained the necessary permits. In addition, a commercial vendor would provide portable restroom facilities where needed and manage the sanitary sewage.

All waste would be handled in accordance with applicable environmental, occupational safety, and public health and safety requirements to minimize the possibility of adverse impacts from construction to plants, animals, soils, water resources, and air quality inside or outside the region of influence.

Operations. The use of a branch rail line in any of the five corridors would result in wastes from the maintenance of rolling and stationary railroad equipment and track. These wastes would include lubricants from equipment and machinery; solvents, paint, and other hazardous material; sanitary waste; and industrial wastes typical for operations of a small branch rail line. Operational wastes would include those generated during equipment maintenance. Maintenance of each locomotive would generate about 420 liters (110 gallons) of waste oil (DIRS 155559-Best 2001, all) that would be reclaimed rather than disposed. Worn or damaged parts and components would be repaired or remanufactured and returned to use. Routine maintenance of newer model rail cars would consist primarily of inspection and replacement of worn or damaged components. However, these cars are designed to last many years. In addition, sealed components would minimize the need for lubrication (DIRS 155558-Hoganson 2001, all). Routine maintenance and repair of rolling equipment would be performed at maintenance and repair yards operated by an independent contractor. Wastes from the maintenance of fixed rail line equipment such as signals and rail crossings would be minimal (DIRS 155560-Hoganson 2001, all). Crossties, ballast, rails, and bridges would be unlikely to require replacement before 2033 (DIRS 152540-Hoganson 2000, all). The management and disposition of operational wastes would comply with applicable environmental, occupational safety, and public health and safety regulations. Wastes would be handled such that adverse impacts from rail corridor operation waste to plants, animals, soils, air quality, and water resources along the right-of-way would be minimized.

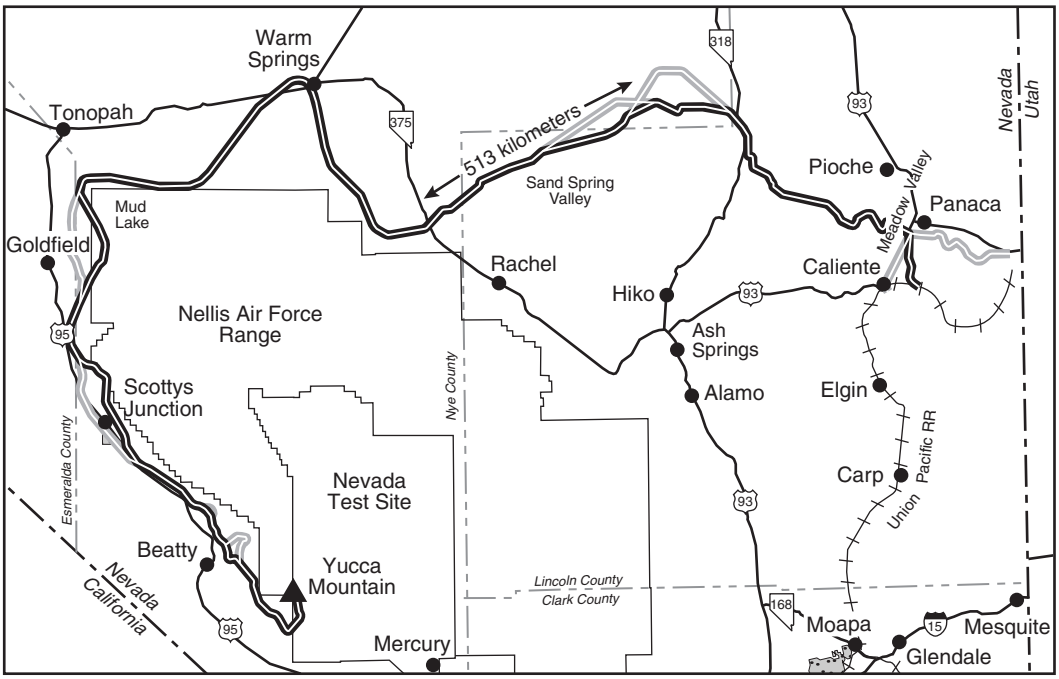
There would be no waste management impacts unique to any of the branch rail line implementing alternatives.

6.3.2.2 Impacts Specific to Individual Rail Corridor Implementing Alternatives

6.3.2.2.1 *Caliente Corridor Implementing Alternative*

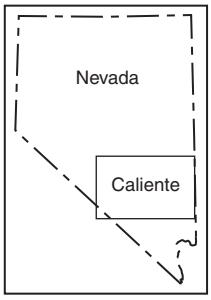
The Caliente Corridor would originate at an existing siding to the Union Pacific mainline railroad at Eccles siding near Caliente, Nevada (Figure 6-15). The corridor travels west, traversing the Chief, North Pahroc, Golden Gate, and Kawich Mountain Ranges. The Caliente and Carlin corridors converge near the northwest boundary of the Nellis Air Force Range. Past this point, the corridors are identical. The Caliente Corridor is 513 kilometers (319 miles) long from the Union Pacific line connection to the Yucca Mountain site. Variations of the route range from 512 to 553 kilometers (318 to 344 miles). Figure 6-15 shows this corridor, along with possible variations identified by engineering studies (DIRS 131242-CRWMS M&O 1997, all). The corridor variations provide flexibility in addressing engineering, land-use, or environmental resource issues that could arise in a future, more detailed survey along the corridor. This section addresses impacts that would occur along the corridor shown in Figure 6-15. With the exception of the differences identified in Appendix J, Section J.3.1.2, the impacts would be generally the same among the possible variations.

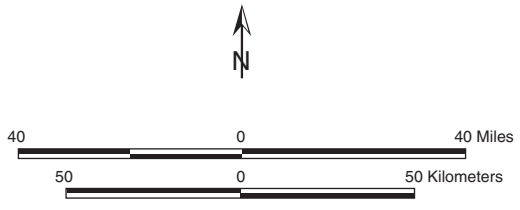
Construction of a branch rail line in the Caliente corridor would require approximately 46 months. Construction would take place simultaneously at multiple locations along the corridor. An estimated six construction camps at roughly equal distances along the corridor would provide temporary living accommodations for construction workers and construction support facilities. A train would take about



Legend

- Existing rail line
- Highway
- Federally recognized Native American lands
- State line
- County line
- Rail corridor
- Variation of rail corridor





To convert kilometers to miles, multiply by 0.62137.

Source: Modified from DIRS 104560-YMP (1998, all).

Figure 6-15. Caliente Corridor.

10 hours to travel from the junction with the Union Pacific mainline to a Yucca Mountain Repository on a Caliente branch rail line (DIRS 101214-CRWMS M&O 1996, Volume 1, Section 4, Branch Line Operations Plan). The estimated life-cycle cost of constructing and operating a branch rail line in the Caliente Corridor would be $880 million in 2001 dollars.

The following sections address impacts that would occur to land use; biological resources and soils; cultural resources; hydrology including surface water and groundwater; occupational and public health and safety; socioeconomics; noise and vibration; and utilities, energy, and materials. Impacts that would occur to air quality, aesthetics, and waste management would be the same as those described in Section 6.3.2.1 and are not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

6.3.2.2.1.1 Caliente Rail Land Use and Ownership

Table 6-23 summarizes the amount of land required for the Caliente corridor, its ownership, and the estimated amount of land that would be disturbed, as well as ranges for the variations. Table 6-24 summarizes the amount of land required for the Caliente Corridor variations and its ownership.

Table 6-23. Land use in the Caliente Corridor.[a]

Factor	Corridor (percent)	Range due to variations
Corridor length (kilometers)[b]	513	512 - 553
Land area in 400-meter[c]*-wide corridor (square kilometers)*[d]	205 (100)	205 - 221
Land ownership in 400-meter-wide corridor (square kilometers)		
Bureau of Land Management	188 (92)[e]	188 - 216
Air Force	10.9 (5.3)	0 - 10.9
DOE	4.6 (2.3)	4.6 - 4.6
Private	0.9 (0.46)	0.9 - 2.5
Tribal	None	0 - 1.6
Land area in 60-meter[f] right-of-way *(square kilometers)*	30.7	30.7 - 33.2
Disturbed land (square kilometers)		
Inside 60-meter right-of-way	14.7	14.7 - 15.9
Outside 60-meter right-of-way	3.6	3.6 - 3.9

a. Source: DIRS 155549-Skorska (2001, all).
b. To convert kilometers to miles, multiply by 0.62137.
c. 400 meters = about 0.25 mile.
d. To convert square kilometers to acres, multiply by 247.1.
e. Percentages do not total 100 due to rounding.
f. 60 meters = 200 feet.

Construction. This corridor crosses several telephone, pipeline, highway, and power line rights-of-way, areas designated as available for sale or transfer, and oil and gas leases (DIRS 104993-CRWMS M&O 1999, Table 2, p. 10 and Table 3, p. 11). The corridor crosses Bureau of Land Management lands used for recreation, nine grazing allotments (Bennett Springs, Highland Peak, Black Canyon, Reveille, Ralston, Stone Cabin, Montezuma, Magruder Mountain, and Razorback), and seven wild horse and burro herd management areas. Section 6.3.2.1 discusses impacts common to all rail implementing alternatives. This section discusses impacts unique to a branch rail line in the Caliente Corridor.

The corridor passes just east of the Weepah Spring Wilderness Study Area and just north of the Worthington Mountains Wilderness Study Area. It also passes near the Kawich Wilderness Study Area and crosses a portion of the South Reveille Wilderness Study Area. The Kawich Area in the Kawich Range and the South Reveille Area in the Reveille Range and along Reveille Valley form a narrow corridor through which the Caliente Corridor passes. A portion of the Kawich and South Reveille Ranges have Bureau of Land Management Class II aesthetic classifications. Construction activities in the vicinity of a Wilderness Study Area could affect the experience in the wilderness environment. As indicated in Appendix J, Section J.3.1.2, the White River Alternate would be more distant from the Area. This route

Table 6-24. Possible variations in the Caliente Corridor.[a]

Variation	Length (kilometers)[b]	Land area in variation (square kilometers)[c]	Ownership in variation [square kilometers (percent)]		
			Bureau of Land Management	Private	Tribal
Eccles Option	16.7	6.7	6.3 (95)	0.4 (5)	--[e]
Caliente Option	17.2	6.9	6.2 (90)	0.69 (10)	--
Crestline Option	37.8	15.1	14.5 (95.9)	0.6 (4.1)	--
White River Alternate	47.5	19	18.98 (99.9)	0.02 (< 0.1)	--
Garden Valley Alternate	37.7	15.1	15.1 (100)	0	--
Mud Lake Alternate	(f)	(f)	(f)	--	--
Goldfield Alternate	45.8	18.3	17.6 (96)	0.7 (4)	--
Bonnie Claire Alternate	42.2[g]	16.9	14.8 (87.4)	0.5 (3)	1.6 (10)
Oasis Valley Alternate	5.57	2.2	2.0 (89)	0.2 (11)	--
Beatty Wash Alternate	23.0	9.2	9.2 (100)	0	--

a. Source: DIRS 155549-Skorska (2001, all).
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert square kilometers to acres, multiply by 247.1.
d. NA = not applicable; length included in total corridor distance.
e. -- = none.
f. Mud Lake Alternate on Bureau of Land Management land included in other variations.
g. Includes 4.5 kilometers (2.8 miles) through Timbisha Shoshone Trust Lands.

variation would cross a small additional amount of private property. Impacts of constructing a branch rail line between the Kawich and South Reveille Areas would be less if DOE implemented Bureau of Land Management Class II requirements for building in these areas.

The Bonnie Claire Alternate of this corridor, in the vicinity of Scottys Junction, would pass through and bisect an 11.3-square-kilometer (2,800-acre) portion of the Timbisha Shoshone Trust Lands (DIRS 155930-Reynolds, Pool, and Abbey 2001, all). Bisecting this parcel could limit its proposed use, which includes tourism and housing for the Timbisha Shoshone.

If the Bonnie Claire Alternate was not used, the corridor would encroach on the Nellis Air Force Range (also known as the Nevada Test and Training Range). In addition, the Mud Lake Alternative would encroach on the Range. The U.S. Air Force has noted the potential for safety risks of crossing lands that are hazard areas and encompass weapons safety footprints for live weapons deployment. For each of the sections that could enter the Nellis Range, DOE has identified a corridor variation that would avoid the potential land-use conflict (see Appendix J, Section J.3.1.2).

If DOE decided to build and operate a branch rail line in the Caliente Corridor, it would consult with the Bureau of Land Management, the U.S. Air Force, and other affected agencies and Native American governments to help ensure that it avoided or mitigated potential land-use conflicts associated with the alignment of a right-of-way. Because the Military Lands Withdrawal Act of 1999 (Public Law 106-65, 113 Stat. 885) withdraws and reserves the Nellis Air Force Range for use by the Secretary of the Air Force, the Secretary would need to concur with a decision to build and operate a branch rail line through any part of the Range.

The presence of a rail line could influence future development and land use along the railroad in the communities of Beatty, Caliente, Goldfield, Scottys Junction, and Warm Springs (that is, zoning and land use might differ depending on the presence or absence of a railroad), as well as a potential Timbisha Shoshone community at their Trust Lands parcel near Scottys Junction.

Operations. DOE expects operations along the Caliente Corridor to cause fewer impacts than the construction phase of the project.

The operation of a rail line in the vicinity of the Weepah Spring Wilderness Study Area could affect the experience of visitors to the Area. The White River Alternate would not pass near the Area, as indicated in Appendix J, Section J.3.1.2. The proximity of an operational rail line to the Kawich and South Reveille Wilderness Study Areas probably would affect these areas by drawing attention to the rail line during operational or maintenance activities.

The operation of a rail line along the Bonnie Claire Alternate could limit or potentially enhance economic development in the Timbisha Shoshone Trust Lands parcel and could limit the use for housing by restricting access. The alternate currently passes almost directly through the center of the parcel.

6.3.2.2.1.2 Caliente Rail Hydrology

Surface Water

Surface-water resources along the Caliente Corridor are discussed in Chapter 3, Section 3.2.2.1.3, and summarized in Table 6-25. The table indicates that the number of surface-water resources in the vicinity of the corridor could vary if DOE used corridor variations, but only by small numbers. In fact, the Caliente Corridor has the smallest number of nearby water resources with the possible exception of the Oasis Valley Alternate. This alternate would be farther away from one identified spring such that the spring's location would no longer be within the 400-meter (0.25-mile)-wide corridor. The spring would, however, still be within 1 kilometer (0.6 mile) of the corridor. As discussed in Section 6.3.2.1, impacts during construction or operations from the possible spread of construction-related materials by precipitation or intermittent runoff events, releases to surface water, or the alteration of natural drainage patterns or runoff rates that could affect downgradient resources would be unlikely.

Table 6-25. Surface-water resources along Caliente Corridor and its variations.[a,b,c]

	Resources in 400-meter[d] corridor			Resources outside corridor within 1 kilometer[e]		
Description	Spring	Stream/ riparian area	Reservoir	Spring	Stream/ riparian area	Reservoir
Caliente Corridor	1	3	--[f]	5	--	--
with Crestline Option	1	3	--	7	--	--
with Caliente Option	2	3	--	7	--	--
with Goldfield Alternate	1	3	--	7	--	--
with Oasis Valley Alternate	--	3	--	6	--	--

a. Source: reduced from tables in Chapter 3, Section 3.2.2.1.3.
b. Resources are the number of locations; that is, a general location with more than one spring was counted as one water resource.
c. Resources shown for variations are for the entire corridor with only the identified changes. Variations not listed (White River Alternate, Garden Valley Alternate, Mud Lake Alternate, Bonnie Claire Alternate, and Beatty Wash Alternate) are not associated with any identified water resources, nor would they avoid any resources along the corridor.
d. 400 meters = about 1,300 feet.
e. 1 kilometer = 0.6 mile.
f. -- = none.

Flood zones identified along the Caliente Corridor and its variations are listed in Table 6-26. As indicated in the table's footnotes, the 100-year flood zone information is summarized from Federal Emergency Management Agency maps, which provide coverage for about half the corridor's length. Based on the available data, this corridor would cross nine different 100-year flood zones or flood zone groups between its beginning near Caliente and when it enters the Nevada Test Site. None of the variations would change this number notably. Use of the Crestline Option would decrease the number of flood zones by one, and the other applicable variations would leave the number unchanged or increased by one. As indicated in Section 6.3.2.1, impacts associated with altering drainage patterns or changing erosion and sedimentation rates or locations would be minor and localized.

Table 6-26. 100-year flood zones crossed by the Caliente Corridor and its variations.[a,b]

Rail corridor portion	Crossing distance (kilometers)	Flood zone feature(s)	Avoided by variation (Yes or No)
Eccles Siding to Meadow Valley	0.2[c]	Clover Creek (intermittent)	Y-1
	0.8[c]	Meadow Valley Wash (wet)	Y-1, 2
Meadow Valley Wash to Sand Spring Valley	0.5[c]	White River (intermittent)	N
Sand Spring Valley to Mud Lake	1.1	Unnamed drainage gully on FEMA map in East/Central Nye County; crosses twice (dry)	N
	17.5	Mud Lake basin and drainage tributaries (normally dry)	N
Mud Lake to Yucca Mountain	0.8	Unnamed washes to the north and south of Ralston (dry)	N
	0.3	Tolicha Wash (intermittent)	Y-7
	1.1	Amargosa River (wet in sections, intermittent in others)	Y-8
	0.1	Beatty Wash (intermittent)	Y-9
Variations			
1. Crestline Option	0.8	Crosses Meadow Valley Wash (wet)	
2. Caliente Option	0.8	Crosses Meadow Valley Wash (wet)	
	0.2	Crosses Clover Creek (intermittent)	
	0.9	Crosses Meadow Valley Wash (wet) three times, rail corridor runs adjacent to Meadow Valley Wash. Passes in and out of flood zone	
3. White River Alternative	None	Located to the north of the corridor	
4. Garden Valley Alternative	None	Located to the north of the corridor	
5. Mud Lake Alternative	3.1	Crosses a larger amount of the Mud Lake flood zone (3.1 kilometers vs. 1.8 kilometers for the corridor)	
6. Goldfield Alternative	None	Located to west of corridor.	
7. Bonnie Claire Alternative	1.3	Crosses an unnamed wash south of Ralston	
	0.7	Crosses Tolicha Wash (intermittent)	
8. Oasis Valley Alternative	1.0	Crosses Amargosa River (wet in segments, intermittent in others)	
9. Beatty Wash Alternative	0.1	Crosses Beatty Wash (intermittent)	

a. Areas where natural floodwater movement might be altered and where erosion and sedimentation rates and locations could change. Sources:
   1. Federal Emergency Management Agency Flood Insurance Rate Maps for Lincoln and Nye Counties, Nevada.
   2. DIRS 154961-CRWMS M&O (1998, all).

b. About 47 percent of the Caliente Corridor is not available on maps, due primarily to limited coverage in Lincoln County, the Nellis Air Force Range, and the Nevada Test Site.

c. Projected from limited data. The specific area is not covered by Federal Emergency Management Agency maps; values were extrapolated from the closest maps.

d. Certain 100-year flood zones can be avoided by alternate corridor segments. These are identified with a "Y" (yes) and a number representing the specific variations from the second half of the table that avoids the specific flood zone. The same flood zone could be crossed by the corridor and its variations at different locations. In such cases, the feature will be marked "Avoided" for the corridor, but will appear again for the variation.

Groundwater

Construction. The water used during construction would come largely from groundwater resources. The annual demands would be a fraction of the perennial yields of most producing aquifers (see Chapter 3, Section 3.2.2.1.3, for estimated perennial yields for the hydrographic areas over which a branch rail line in the Caliente Corridor would pass).

HYDROGRAPHIC AREA

The Nevada Division of Water Planning has divided the State into groundwater basins, or *hydrographic areas*. These areas are used in the management of groundwater resources. Hydrographic areas are generally based on topographic divides (that is, they typically comprise a valley, a portion of a valley, or a terminal basin), but can also be based on administrative divisions. The State classifies a hydrographic area as a Designated Groundwater Basin when the permitted water rights (or appropriations) approach or exceed the area's estimated perennial yield and the water resources are depleted or require additional administration. The Division of Water Planning's home page *http://www.state.nv.us/cnr/ndwp* identifies the hydrographic areas that are Designated Groundwater Basins.

The amount of water needed for the construction of a branch rail line in the Caliente Corridor for soil compaction, dust control, and workforce use would be about 880,000 cubic meters (710 acre-feet) (DIRS 104914-DOE 1998, all). For planning purposes, DOE assumed that this water would come from 64 wells installed along the rail corridor. The average amount of water withdrawn from each well would be approximately 14,000 cubic meters (11 acre-feet). Most (91 percent) of the water need would be for use in the compaction of fill material. The estimate of fill quantities needed for construction would change if variations were used. However, no single variation applicable to the Caliente Corridor would increase the estimate of water demand by more than 5 percent.

Chapter 3, Section 3.2.2.1.3, discusses the hydrographic areas over which the Caliente rail corridor would pass, their perennial yields, and whether the State of Nevada considers each a Designated Groundwater Basin. If the hydrographic area is a Designated Groundwater Basin, permitted groundwater rights approach or exceed the estimated perennial yield, depleting water resources or requiring additional administration. Table 6-27 summarizes the status of the hydrographic areas associated with the Caliente Corridor and the approximate portion of the corridor that would pass over Designated Groundwater Basins. Use of corridor variations would make no notable difference in the portion of the corridor that crosses Designated Groundwater Basins.

Table 6-27. Hydrographic areas along Caliente Corridor and its variations.

		Designated Groundwater Basins	
Corridor description	Hydrographic areas	Number	Percent of corridor length
Caliente Corridor	17	6	40
Variations[a]	16 to 18	6	40

a. Several of the variations would involve small changes in the hydrographic areas crossed or the crossing distances. However, all (Caliente Option, Crestline Option, White River Alternate, Garden Valley Alternate, Mud Lake Alternate, Goldfield Alternate, Bonnie Claire Alternate, and Oasis Valley Alternate) would cross the same six Designated Groundwater Basins which, rounded to the nearest 10 percent, would represent the same portion of the total corridor.

The withdrawal of about 14,000 cubic meters (11 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the Caliente Corridor based on their perennial yields (Chapter 3, Section 3.2.2.1.3). However, the installation of 64 wells along the corridor would mean that many hydrographic areas would have multiple wells. As Table 6-27 indicates, about 40 percent of the corridor length would be over Designated Groundwater Basins, which the Nevada State Engineer's office watches carefully for groundwater depletion. This does not mean that DOE could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. Because the DOE requests would be for a short-term construction action, the State Engineer would have even more discretion. Rather than spacing the wells evenly along the corridor, DOE could use locations that would make maximum use of groundwater areas that are not Designated Groundwater Basins. Another option would be to lease temporary water rights from individuals along the corridor. Obtaining a water appropriation from the State Engineer for short-term construction use or using an approved allocation should ensure that groundwater resources would not be adversely affected.

As an alternative, DOE could transport water by truck to meet construction needs. The construction of a branch rail line in the Caliente Corridor would require about 47,000 tanker-truck loads of water or about eight truckloads each day for each work camp along the corridor. Again, water obtained from permitted sources, which would be within allocations determined by the Nevada State Engineer, would not affect groundwater resources.

Operations. Operations along a completed rail line would have little impact on groundwater resources. There would be no changes in recharge beyond those at the completion of construction.

6.3.2.2.1.3 Caliente Rail Biological Resources and Soils

Construction. The construction of a rail line in the Caliente Corridor including possible variations (see Appendix J, Section J.3.1.2) would disturb approximately 18 square kilometers (4,500 acres) of land (Table 6-23). The analysis assumed that the types of land cover in disturbed areas outside the corridor would be the same as that within the corridor. Areas within 12 of the land-cover types identified in the State of Nevada (DIRS 104593-CRWMS 1999, pp. C1 to C5) would be affected by construction of a branch rail line in the Caliente Corridor (see Table 6-28). The greatest amounts of disturbance would occur in the salt desert scrub and sagebrush land-cover types, but would involve less than 0.001 percent of the existing area of Nevada in those land-cover types. The 0.001 fraction that would be disturbed for each cover type would be very small. The disturbance would have no discernible impact on the availability of habitat in any cover type. Although some alignment variations could lead to a small increase in the total amount of land disturbed, the portion of the corridor, including its variations, in each land-cover type would be similar to the unvaried corridor.

Table 6-28. Maximum area disturbed (square kilometers)[a] in each land-cover type for the Caliente Corridor.[b,c]

Land-cover type	Percent of corridor length	Area disturbed	Area in Nevada	Percent disturbed
Agriculture	0.3	0.05	5,200	0.001
Blackbrush	0.1	0.02	9,900	<0.001
Creosote-bursage	6.0	1.1	15,000	0.007
Grassland	0.2	0.04	2,800	0.001
Greasewood	0.4	0.07	9,500	<0.001
Hopsage	2.0	0.36	630	0.06
Juniper	0.3	0.05	1,400	0.003
Mojave mixed scrub	4.5	0.82	5,600	0.01
Pinyon-juniper	0.0	0	15,000	0.00
Playa	0.1	0.02	7,000	<0.001
Sagebrush	30	5.4	67,000	0.01
Sagebrush/grassland	0.3	0.05	52,000	<0.001
Salt desert scrub	56	10	58,000	0.02
Urban		ND[d]	2,400	ND

a. To convert square kilometers to acres, multiply by 247.1.
b. Based on the proportion of the route in each land-cover type; percent disturbed was based on the variation with the greatest disturbance within a particular land-cover type. Percentages add to more than 100 because maximum values were used.
c. Source: DIRS 104593-CRWMS M&O (1999, Appendix D).
d. ND = not determined.

About 50 kilometers (31 miles) along the southern end of the corridor, including variations in this area, is in desert tortoise habitat. Assuming that a maximum of about 0.06 square kilometer (15 acres) of land would be disturbed for each kilometer of rail line in this area, construction activities would disturb as much as 3 square kilometers (740 acres) of desert tortoise habitat, none of which is classified as critical habitat. In addition, these activities could kill individual desert tortoises; however, their abundance is low in this area (DIRS 103281-Karl 1981, pp. 76 to 92; DIRS 101914-Rautenstrauch and O'Farrell 1998, pp. 407 to 411) so losses would be few. Relocation of tortoises along the route prior to construction

would minimize losses of individuals. The presence of the branch rail line could interfere with the normal movements of individual tortoises. DOE would consult with the Fish and Wildlife Service (under Section 7 of the Endangered Species Act) regarding this species if it selected this corridor and would implement all terms and conditions required by the Fish and Wildlife Service.

Although the southwestern willow flycatcher occurs near some portions of the corridor, including the variations, there is no suitable habitat of dense riparian vegetation for this Federally endangered species in the Caliente Corridor (DIRS 152511-Brocoum 2000, pp. A-9 to A-13).

The only other Federally listed species near the corridor and its variations is the Railroad Valley springfish (Federally threatened), which has been found about 3 kilometers (1.9 miles) north of the corridor, and it should not be affected. The Eccles, Crestline, or Caliente variations of this corridor cross a portion of the Meadow Valley Wash, which is habitat for an unnamed subspecies of the Meadow Valley Wash speckled dace and the Meadow Valley Wash desert sucker, both of which are sensitive species. Construction of a branch rail line in this corridor could temporarily affect populations of these fish by increasing the sediment load in the wash during construction. Four other special status species occur along this corridor and its variations but could be avoided during land-clearing activities (DIRS 104593-CRWMS M&O 1999, p. 3-23) and, therefore, would not be affected.

One population of the Nevada sanddune beardtongue, a sensitive plant species, occurs within the 400-meter (0.25-mile) corridor and could be directly or indirectly affected by land-clearing activities and construction of the branch rail line. The location of this population would be identified through surveys before these activities, and disturbance of the plants would be avoided if possible.

In addition, there are six known populations of four sensitive plant species outside the 400-meter (0.25-mile) corridor, but within 5 kilometers (3 miles). Several additional populations of these four species and one other sensitive plant species occur within 5 kilometers of one or more of the variations listed in Appendix J, Section J.3.1.2. One population of one species (Needle Mountain milkvetch) outside the 400-meter corridor would be avoided by the Caliente Option and three populations of this species would be avoided by the Crestline Option. DOE anticipates that corridor activities would not affect these populations because land disturbance would not extend to these areas and changes would be unlikely in the aquatic or soil environment as a result of construction or the long-term presence of a railroad.

The rail corridor crosses 15 areas designated as game habitat and 8 areas designated as wild horse and burro management areas (see Chapter 3, Section 3.2.2.1.4). Construction activities would reduce habitat in these areas. Depending on the variation, several other designated game habitat areas could be within 5 kilometers (3 miles) of a rail line in the Caliente Corridor. Wild horses, burros, and game animals near these areas during construction would be disturbed and their migration routes could be disrupted.

At least one group of springs and three stream or riparian areas are within the 400-meter (0.25-mile) corridor including its variations (Table 6-26). Although formal delineations have not been made, these springs and riparian areas may be jurisdictional wetlands or other waters of the United States. Construction could increase sedimentation in these areas. In addition, the corridor, including its variations, crosses a number of ephemeral streams that could be classified as waters of the United States. DOE would work with the U.S. Army Corps of Engineers to minimize impacts to these areas and would obtain individual or regional permits if necessary. DOE anticipates some changes to local drainage along a branch rail line, and would design the rail line to accommodate existing drainage patterns.

In addition, as many as 25 known springs and riparian areas occur outside of the 400-meter (0.25-mile) corridor, but within 5 kilometers (3 miles) of the corridor, including its variations. Eight known populations of three sensitive animal species are associated with these aquatic resources. DOE anticipates that corridor activities would not affect these populations because land disturbance would not

extend to these areas and these areas would not be disturbed during the construction or long-term presence of a railroad.

Construction activities would temporarily disturb about 18 square kilometers (4,500 acres) of soils in and adjacent to the corridor. The impacts to soils of disturbing 18 square kilometers along the 513-kilometer-(319-mile)-long corridor would be transitory and small. However, several soil characteristics could influence construction activities and the amount of disturbed area. Soils susceptible to water or wind erosion occur along much of the corridor and its variations as do soils exhibiting relatively high shrink-swell characteristics (see Chapter 3, Section 3.2.2.1.4). Disturbance of erodible soils could lead to increased silt loads in water courses or increased soil transport by winds. Erosion control during construction and revegetation, or other means of soil stabilization after construction, would minimize these concerns. The presence of soils with poor (that is, high) shrink-swell characteristics could influence the amount of disturbed area if soils from outside areas were brought in for replacement or mixing with the native soil.

As stated in Chapter 3, Section 3.2.2.1.4, the variations identified for the Caliente Corridor could avoid some biological resources, as listed in Table 6-29.

Table 6-29. Biological resources avoided by Caliente Corridor variations.[a]

	Occurrence of resource			
	For unvaried segment of corridor		Occurrence avoided by variation	
Alignment variation resource	In corridor[b]	Within 5 km[c]	In corridor	Within 5 km
Caliente variation[d]				
Sensitive species–Needle Mountain milkvetch	0	3	0	1
Springs or groups of springs	4	24	0	1
Crestline variation				
Sensitive species–Needle Mountain milkvetch	0	3	0	3
Springs or groups of springs	4	24	0	4

a. The only corridor variations listed are those that would result in the avoidance of biological resources along the corridor.
b. In the corridor [or springs within 400 meters (0.25-mile)], but avoided by the corridor variation.
c. Within 5 kilometers (3 miles) of the corridor, but more than 5 kilometers from the corridor variation.
d. Appendix J, Section J.3.1.2, lists variations for the Caliente Corridor implementing alternative.

6.3.2.2.1.4 Caliente Rail Cultural Resources

Construction. Site file searches for the Caliente Corridor and its variations (see Appendix J, Section J.3.1.2) yielded 97 recorded archaeological sites, 36 of which are either potentially eligible or have not been fully evaluated for the *National Register of Historic Places* (Chapter 3, Section 3.2.2.1.5). If DOE selected this corridor, it would conduct on-the-ground surveys of the 400-meter (0.25-mile)-wide corridor before and during construction activities to determine if construction of a branch rail line in this corridor could disturb sites or crush artifacts at archaeologic and historic sites.

At various points along the route, the Caliente Corridor and its variations intersect physical vestiges of historic railroads, including the Caliente and Pioche, Tonopah and Goldfield, and Las Vegas and Tonopah Railroads. The corridor also intersects the 1849 Jayhawker Emigrant Trail in Lincoln and Nye Counties. It passes close to three *National Register of Historic Places* properties—the Union Pacific Depot in Caliente (Caliente variation), the Tonopah Multiple Resource Area, and the Goldfield Historic District (Goldfield variation). However, the corridor and its variations passes these resources at a distance where adverse impacts would be unlikely. Southeast of Tonopah, the route passes through the former bombing range of the World War II Tonopah Army Air Station. Features related to that activity would be likely to occur on the landscape, but precise identification would not be possible until the completion of a cultural resource field inventory.

No areas or properties of interest to Native Americans have been identified and field-verified in the Caliente Corridor or its variations. However, the proposed right-of-way is near several potentially significant areas, including the Wild Horse and Willow Springs vicinity east of Goldfield (Caliente Corridor and Goldfield variation), the Oasis Valley north of Beatty (Oasis Valley Alternate), Crater Flat, and the Busted Butte-Fortymile Canyon area near the repository (DIRS 155826-Nickens and Hartwell 2001, all). In addition, the Bonnie Claire Alternate of the Carlin and Caliente Corridors passes through the land at Scottys Junction recently transferred to the Timbisha Shoshone Tribe.

Operations. As stated in Section 6.3.2.1, additional impacts to these resources during the operation of the branch rail line would be unlikely.

6.3.2.2.1.5 Caliente Rail Occupational and Public Health and Safety

Construction. Industrial safety impacts on workers from the construction and use of the Caliente branch rail line would be small. The analysis evaluated the potential for impacts in terms of total reportable cases of injury and illness, lost workday cases, and fatality risks to workers and the public from construction and operation activities. Table 6-30 lists these results.

Table 6-30. Impacts to workers from industrial hazards during rail construction and operations in the Caliente Corridor.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	110	95
Lost workday cases	55	52
Fatalities	0.2	0.3
Noninvolved workers		
Total recordable cases	6.7	5.4
Lost workday cases	2.5	2.0
Fatalities	0.01	0.01
Totals[d]		
Total recordable cases	120	100
Lost workday cases	57	54
Fatalities	0.2	0.3

a. Totals for 46 months of construction.
b. Totals for 24 years of operations.
c. Total recordable cases includes injury and illness.
d. Totals might differ from sums due to rounding.

The analysis also evaluated traffic fatality impacts that would occur during the moving of equipment and materials for construction, worker commutes to and from construction sites, and transport of water to construction sites if wells were not available. Table 6-31 lists these results.

Operations. Incident-free radiological impacts would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste in the Caliente Corridor. Table 6-32 lists the incident-free impacts, which include transportation along the Caliente Corridor and along railways in Nevada leading to a Caliente branch line. The table includes the impacts of 1,079 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks while operational.

6.3.2.2.1.6 Caliente Rail Socioeconomics

The following paragraphs discuss potential socioeconomic impacts associated with the construction and operation of a branch rail line in the Caliente Corridor.

Construction. The length of the Caliente Corridor—513 kilometers (319 miles)—is the most important factor for determining the number of workers that would be required. To construct a branch rail line in this corridor would require workers laboring approximately 2.8 million hours or 1,410 worker years during the 46-month construction period (DIRS 154822-CRWMS M&O 1998, all). The route would require six construction camps to house workers temporarily.

Employment

DOE anticipates that total (direct and indirect) employment in the region of influence attributable to the Caliente branch rail line would peak in the first year of construction, 2006, at about 842 workers. Clark County would gain about 664 workers and Nye County would gain 101. The increase in employment

Table 6-31. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Caliente Corridor.

Activity	Kilometers[a]	Traffic fatalities	Emissions fatalities
Construction			
Material delivery vehicles	20,000,000	0.3	0.04
Commuting workers	85,000,000	0.8	0.11
Subtotals	*100,000,000*	*1.2*	*0.15*
Operations			
Commuting workers	68,000,000	0.7	0.09
Totals	***170,000,000***	***1.9***	***0.24***

a. To convert kilometers to miles, multiply by 0.62137.

Table 6-32. Health impacts from incident-free Nevada transportation for the Caliente Corridor implementing alternative.[a]

Category	Legal-weight truck shipments	Rail shipments	Totals[b]
Involved workers			
Collective dose (person-rem)	38	810	850
Estimated LCFs[c]	0.02	0.32	0.34
Public			
Collective dose (person-rem)	7	12	19
Estimated LCFs	0.003	0.01	0.01
Estimated vehicle emission-related fatalities	0.0016	0.0056	0.0071

a. Impacts are totals for 24 years.
b. Totals might differ from sums of values due to rounding.
c. LCF = latent cancer fatality.

represents less than 1 percent of the baseline employment in Clark and Nye Counties. The additional 77 workers would represent a 3.2-percent increase of the employment baseline for Lincoln County. Changes in the Lincoln County level of employment would be the result primarily of indirect employment created by the presence of the transient construction workers.

Employment of Caliente Corridor construction workers and some indirect support workers would end in 2009. As a result, the projected total growth (2009 to 2010) of 15,240 jobs in the region of influence would be reduced by 827. The expected addition of 14,886 jobs in Clark County would be reduced by 788, and the expected growth of 330 jobs in Nye County would be reduced by 53. The expected growth of 24 jobs in Lincoln County would be supplemented by a net gain of 14. DOE anticipates that project-related workers not moving to Caliente Corridor operational jobs would be absorbed in other work in the State. These changes in employment would represent less than 1 percent of the applicable baselines.

Population

Population increases in the region of influence associated with the construction of a Caliente branch rail line would peak in 2009 at about 822 persons. About 728 individuals would live in Clark County, 64 in Nye County, and 29 in Lincoln County. The estimated population increase attributable to the rail construction in the three counties is less than 1 percent of each county's population baseline. Because the change in population in relation to the population baseline would be small and transient, impacts to housing or schools would be unlikely.

Economic Measures

The expected peak annual changes in economic measures in the region of influence attributable to the Caliente Corridor would be increases of $24.3 million in real disposable income in 2009; $40.3 million in Gross Regional Product in 2007; and $2.8 million in State and local expenditures in the final year of construction, 2009. Clark County would generate more than 94 percent of the Gross Regional Product, experience more than 94 percent of the increase in real disposable income, and absorb more than 83

percent of the increase in expenditures by State and local governments. Nye and Lincoln Counties would share the remainder. (All dollar values in this section are in 2001 dollars unless otherwise stated).

Construction-related impacts to real disposable income, Gross Regional Product, and State and local government expenditures would be a less-than-1 percent increase for Clark and Nye Counties. Although the estimated increase in Lincoln County's Gross Regional Product would be about 1.6 percent of the baseline in 2006, increases in Gross Regional Product during the other years of construction. The increases in real disposable income would be about 1.2 percent in 2006 and less than 1 percent in other years. Increases in State and local government expenditures during all years of construction would be less than 1 percent from the County's baselines.

Transition and Operations Period. Employment opportunities associated with the construction of the branch rail line would probably dissipate at the project's completion and reduce the region's employment by 46 positions annually for 4 years. However, Nye County would have a net gain of 6 jobs and Lincoln County would have a net gain of 56 employment positions above the baseline. The additional job gain in Lincoln County represents a 2.2-percent average increase over the employment baseline in the referenced 4-year period. The employment gain in Nye County would be less than 1 percent. Constructing and operating a Caliente branch rail line would contribute to the growth in residential population throughout the transition period and to the employment base after 2013.

Employment and Population

Estimated annual direct employment for Caliente branch rail line operations would be 47 workers. Increased employment in the three counties comprising the region of influence would average about 79 jobs annually over the 24-year operations period (2010 to 2033). DOE anticipates that, on average, approximately 56 of these individuals would work in Lincoln County, representing a 2.1-percent increase of the employment baseline for Lincoln County. Increases in Clark and Nye Counties would be less than 1 percent of the baselines. In the region of influence, the average change to population because of a Caliente branch rail line would be about 351 additional people. DOE anticipates that approximately 95 individuals probably would choose to live in Lincoln County, an addition of 2 percent of the population baseline. The impact due to increases in population in Clark and Nye Counties would be much less than 1 percent of the applicable baseline. Because the impacts to population and employment would be so small in Clark and Nye Counties, impacts to housing or schools would be unlikely in either county. As discussed in Chapter 3, Section 3.1.7.4, Lincoln County has a low occupancy rate for housing; therefore, the impact to Lincoln County's housing market would be very small despite a 2-percent increase in population. The annual impact to schools in Lincoln County resulting from the increase in population would average about 22 additional pupils.

Economic Measures

Within the three-county region of influence, the estimated greatest annual increase above the baseline in real disposable income attributable to operations would occur in 2033, the last year of operation, and would be $6.2 million; annual increases during the 24 years of operation would average $5.2 million. Increases in Gross Regional Product would average about $4.5 million. As discussed above, the region would experience a slower growth in employment for several years. In the case of the Caliente branch rail line, on average during operation, changes in real disposable income would exceed changes in Gross Regional Product. Annual State and local government expenditures during operations, averaging $1.8 million, would be much lower than those reported above for construction. Impacts to real disposable income, Gross Regional Product, and State and local government expenditures from the operation of a Caliente branch rail line would be less than 1 percent of the baseline for Clark and Nye Counties.

In Lincoln County, the impact of the change to the baseline in real disposable personal income and in government spending would be to increase levels by averages of 1.6 percent and 2.4 percent, respectively, for the duration of operations. Changes to the Gross Regional Product would average 2.6 percent above

the baseline. Workers associated with operation of a Caliente rail line would purchase many goods and services in Lincoln County. These dollars would continue to circulate largely in the area, creating a positive economic impact.

DOE performed detailed analyses for the Caliente Corridor branch rail line implementing alternative. The results of the analyses are representative of the potential variations listed in Appendix J, Section J.3.1.2.

In addition, DOE analyzed a sensitivity case that assumed all Lincoln County socioeconomic impacts would occur only in the City of Caliente. Under this assumption, City population would rise by 3 percent (29 persons) during construction and by 6.9 (67 persons) percent during operations. Employment would rise by about 5 percent during construction and about 7.2 percent during operations.

6.3.2.2.1.7 Caliente Rail Noise and Vibration

Over most of its length, the Caliente Corridor passes through undeveloped land managed by the Bureau of Land Management, where human inhabitants are mostly isolated ranchers and persons involved with outdoor recreation. The Towns of Caliente and Panaca are near or along the eastern end of the corridor. The Caliente variation for connecting to the Union Pacific Railroad mainline would follow an old railroad bed through the center of the Town of Caliente. Corridor variations (see Appendix J, Section J.3.1.2) with the exception of Caliente are close enough to the rail line for noise impacts to be significant (Table 6-33). Noise levels in Caliente would not differ much from existing background noise levels associated with normal rail traffic through the community. Noise levels associated with waste shipments would occur at most three times a day and probably not within any given hour. Where the branch rail line passed through Caliente, train speed would be reduced for safety and noise levels would be minimized. There is one traffic crossing in the Town of Caliente where traffic could be delayed. Adverse community response to the added rail noise would be unlikely because of the long-term presence of railroad traffic in Caliente, the short trains associated with transport of waste shipments, and the low frequency of rail trips to and from the Yucca Mountain site.

Table 6-33. Estimated propagation of noise from the operation of waste transport train using two locomotives in communities near the Caliente Corridor.

Community	Distance (kilometers)[a]	Estimated noise (dBA)[b]
Caliente Option		
Caliente	0	>90 at 15 meters[c]
Panaca	6[d]	26.0
Crestline Option		
Panaca	4.5[d]	26.3
Eccles Option		
Caliente	6.5[d]	<26[e]
Tonopah	12[d]	<26
Goldfield	6.2[d]	<26
Beatty	9.6[d]	<26
Beatty Wash Alternate		
Beatty	11.2[d]	<26
Amargosa Valley	9.6[d]	<26

a. To convert kilometers to miles, multiply by 0.62137.
b. Estimated values do not include noise loss due to interactions with the ground that could account for decreases in estimated noise levels from 10 to 20 dBA at 100 meters (330 feet) from the tracks.
c. 15 meters = 49 feet.
d. Noise estimates at distances greater than 2 kilometers (1.2 miles) have large uncertainty.
e. At these distances, the A-weighted sound pressure level is dominated by lower frequencies (lower than 63 Hertz) and would not be distinguishable from normal background levels of noise.

In addition to passing near communities, the Caliente Corridor, including its variations, would pass through areas with farms and ranches. Some rural residences could fall within the region of influence for noise. The corridor, except the Caliente Option that would pass through Caliente, would be at least 4 kilometers (2.5 miles) from every town or community along its length. The noise from trains in these remote communities would not exceed daytime or nighttime noise standards for residential areas (60 or 50 dBA, respectively). Similarly, there would be little potential for noise impacts from construction and operation activities.

The estimated population residing within 2 kilometers (1.2 miles) of the Caliente Corridor in 2035 would be about 350 persons.

The Caliente Corridor would pass within 1.9 kilometers (1.2 miles) of the border of the Timbisha Shoshone Homeland. The Bonnie Claire Alternate would pass through 4.1 kilometers (2.5 miles) of the Timbisha Shoshone Trust Lands parcel near the intersection of State Route 267 and U.S. Highway 95. Noise levels from trains passing through the homeland would be 90 dBA at 15 meters (49 feet) for the Bonnie Claire Alternate. At the closest point of the Caliente Corridor, the estimated noise levels would be 44 dBA. Ethnographic responses to noise have not been determined (see Section 6.1.2.5). However, the noise levels associated with the Caliente Corridor would be lower than those associated with the Bonnie Claire Alternate.

Vibration. With the exception of the historic railroad station in Caliente, which is near the existing Union Pacific Railroad mainline, a branch rail line in the Caliente Corridor would be distant from historic structures, ruins, and buildings. Therefore, vibration impacts would be unlikely except at the Caliente Rail Station. However, the vibrations added by the relatively few trains carrying spent nuclear fuel and high-level radioactive waste at slow speeds through Caliente would not add appreciably to the vibrations to which the station is exposed from commercial train traffic. The small number of trips (two per day) and the small train size would result in low levels of rail-induced ground vibration.

6.3.2.2.1.8 Caliente Rail Utilities, Energy, and Materials

Table 6-34 lists the use of fossil fuel and other materials for the construction of a Caliente branch rail line.

Table 6-34. Construction utilities, energy, and materials for a Caliente branch rail line.

Length (kilometers)[a]	Diesel fuel use (million liters)[b]	Gasoline use (thousand liters)	Steel (thousand metric tons)[c]	Concrete (thousand metric tons)[c]
510 - 550	42 - 45	870 - 940	72 - 78	420 - 460

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.

6.3.2.2.2 *Carlin Corridor Implementing Alternative*

The Carlin corridor originates at the Union Pacific main line railroad near Beowawe in north-central Nevada. Figure 6-16 shows this corridor along with possible variations identified by engineering studies (DIRS 131242-CRWMS M&O 1997, all). The variations provide flexibility in addressing engineering, land-use, or environmental resource issues that could arise in a future, more detailed survey along the corridor. This section addresses impacts that would occur along the corridor shown in Figure 6-16. With the exception of the differences identified in Appendix J, Section J.3.1.2, the impacts would be generally the same among the possible variations.

The corridor travels south through Crescent, Grass, and Big Smoky Valleys, passing west of the City of Tonopah and east of the City of Goldfield. The corridor then travels south following and periodically

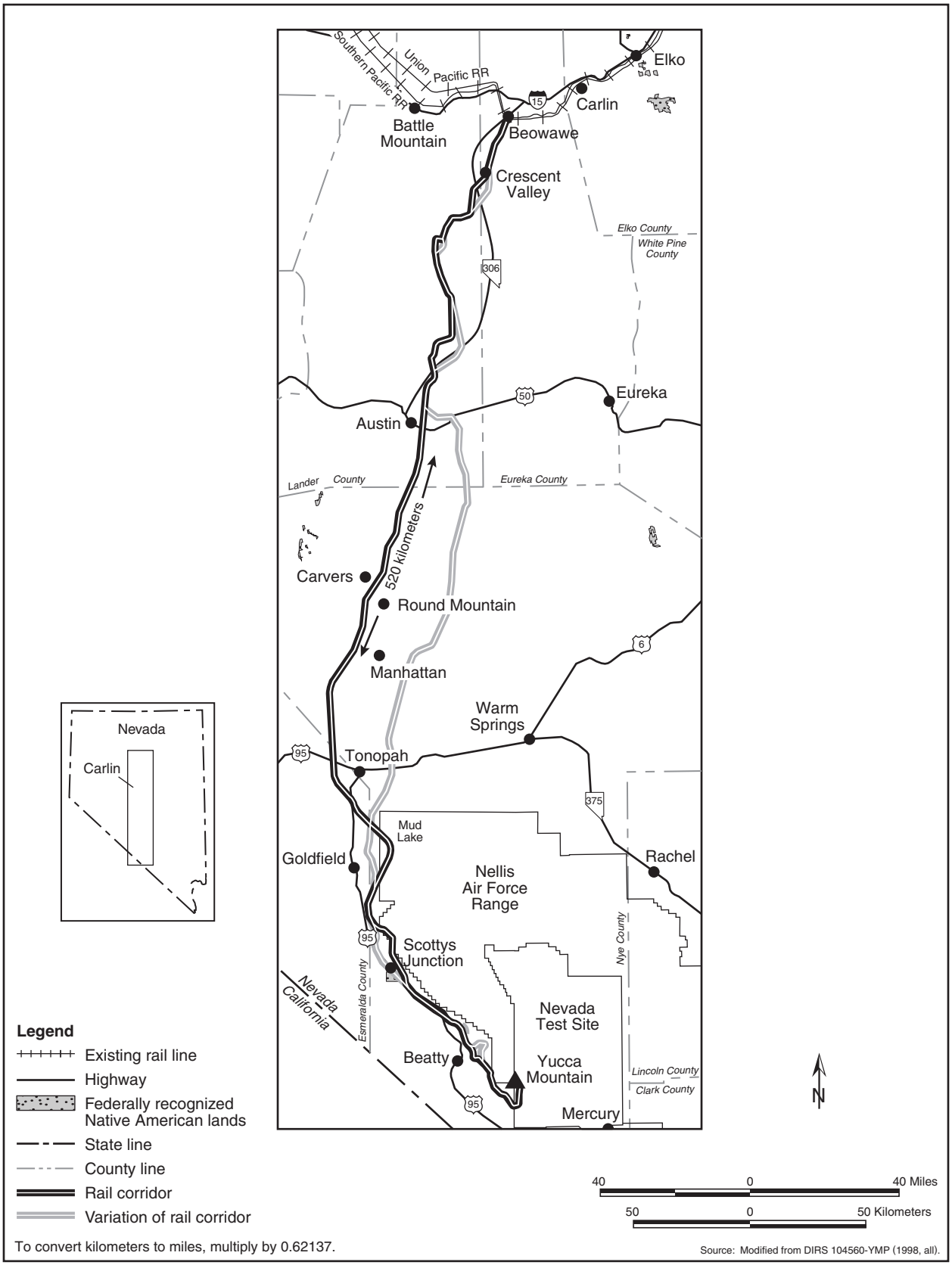


Figure 6-16. Carlin Corridor.

crossing the western boundary of the Nellis Air Force Range, passing through Oasis Valley and Beatty Wash. It travels along Fortymile Wash to the proposed repository location. The Carlin Corridor is about 520 kilometers (323 miles) long from its link with the Union Pacific line to the Yucca Mountain site. Variations of the route range from 513 to 544 kilometers (319 to 338 miles).

The construction of a branch rail line in the Carlin Corridor would require approximately 46 months. Construction would take place simultaneously at multiple locations along the corridor. DOE would establish an estimated five construction camps at roughly equal distances along the corridor. These camps would provide temporary living accommodations for construction workers and construction support facilities. A train would take about 9 hours to travel from the junction with the Union Pacific mainline to the Yucca Mountain site on a Carlin branch rail line (DIRS 101214-CRWMS M&O 1996, Volume 1, Section 4, Branch Line Operations Plan). The estimated life-cycle cost to construct and operate a branch rail line in the Carlin Corridor would be about $821 million in 2001 dollars.

The following sections address impacts that would occur to land use; biological resources and soils; cultural resources; hydrology including surface water and groundwater; occupational and public health and safety; socioeconomics; noise and vibration; and utilities, energy, and materials. Impacts that would occur to air quality, aesthetics, and waste management would be the same as those common impacts discussed in Section 6.3.2.1 and are, therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

6.3.2.2.2.1 Carlin Rail Land Use and Ownership

Table 6-35 summarizes the amount of land required for the Carlin Corridor, its ownership, and the estimated amount of land that would be disturbed, as well as ranges for the variations. Table 6-36 summarizes the amount of land required for the Carlin Corridor variations and its ownership.

Table 6-35. Land use in the Carlin Corridor.[a]

Factor	Corridor (percent)	Range due to variations
Corridor length (kilometers)[b]	520	513 - 544
Land area in 400-meter[c]*-wide corridor (square kilometers)*[d]	208 (100)	205 - 218
Land ownership in 400-meter-wide corridor (square kilometers)		
Bureau of Land Management	179 (86)	177 - 201
Air Force	11 (5.2)	0 - 10.9
DOE	4.6 (2.2)	4.6 - 4.6
Private	14 (6.7)	7.3 - 15.2
Tribal	None	0 - 1.6
Land area in 60-meter[e] *right-of-way (square kilometers)*	31.2	30.8 - 32.6
Disturbed land (square kilometers)		
Inside 60-meter right-of-way	17	16.7 - 17.7
Outside 60-meter right-of-way	2.3	2.2 - 2.4

a. Source: DIRS 155549-Skorska (2001, all).
b. To convert kilometers to miles, multiply by 0.62137.
c. 400 meters = about 0.25 mile.
d. To convert square kilometers to acres, multiply by 247.1.
e. 60 meters = 200 feet.

Construction. The Carlin Corridor crosses various telephone, highway, and utility rights-of-way. The corridor also crosses a Desert Land Entry withdrawal, 12 Bureau of Land Management grazing allotments (Carico Lake, Dry Creek, Grass Valley, Kingston, Simpson Park, Wildcat Canyon, Big Smoky, Francisco, San Antone, Montezuma, Magruder Mountain, and Razorback) and six wild horse and burro herd management areas. Other areas crossed by the corridor include the Bates Mountain antelope release area,

Table 6-36. Possible variations in the Carlin Corridor.[a]

Variation	Length (kilometers)[b]	Land area in variation (square kilometers)[c]	Ownership in variation [square kilometers (percent)]		
			Bureau of Land Management	Private	Tribal
Crescent Valley Alternate	24.4	9.8	7.2 (77)	2.3 (23)	--[d]
Wood Spring Canyon Alternate	11.7	4.7	4.7 (100)	0	--
Rye Patch Alternate	35.3	14.1	14.1 (100)	0	--
Steiner Creek Alternate	41.5	16.6	16.6 (100)	0	--
Big Smoky Valley Option	197	78.9	78.9 (100)	0	--
Monitor Valley Option	225.4	90.2	90.2 (100)	0	--
Mud Lake Alternate	(e)	(e)	(e)	--	--
Goldfield Alternate	43.1	18.3	17.6 (96)	0.7 (4)	--
Bonnie Claire Alternate	42.2[f]	16.9	14.3 (87)[g]	0.4 (3)	1.6 (10)
Oasis Valley Alternate	5.57	2.2	2.0 (89)	0.2 (11)	--
Beatty Wash Alternate	23.0	9.2	9.2 (100)	0	--

a. Source: DIRS 155549-Skorska (2001, all).
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert square kilometers to acres, multiply by 247.1.
d. -- = none.
e. Mud Lake Alternate included in other variations.
f. Includes 4.5 kilometers (2.8 miles) of Timbisha Shoshone Tribal land.
g. Includes 18 square kilometers (450 acres) of Timbisha Shoshone Tribal land.

three designated riparian habitats, and the Simpson Park habitat management area. It does not cross any oil or gas exploration and extraction areas. However, Bureau of Land Management lands are open to mineral and oil and gas exploration. The corridor passes through Bureau lands that are used for recreation, but does not pass through state or national forests. It does pass through areas adjacent to such facilities.

The construction of a branch rail line through Desert Land Entry withdrawal areas could affect the economic development of such properties by removing a portion of the lands and transferring it to DOE. If such property was divided, continued access to the property would be required. Construction impacts would be similar to those discussed in Section 6.3.2.1. As with the Caliente Corridor, the Bonnie Claire Alternate in the vicinity of Scottys Junction would pass through and divide an 11.3-square-kilometer (2,800-acre) portion of the Timbisha Shoshone Trust Lands (DIRS 155930-Reynolds, Pool, and Abbey 2001, all). The construction of a branch rail line in the Bonnie Claire Alternate could limit or potentially enhance economic development in the Timbisha Shoshone Trust Lands parcel and could limit the use for housing by restricting access.

The withdrawal of property from the private sector and the transfer of public lands would occur under existing government protocols. The withdrawal of lands from private ownership could impact area city and county economic expansion through the loss of tax revenues.

There are current mining operations in the Cortez Mine area of Crescent Valley. These operations, along with the historic mines in the area, make continued mining of this area a probability. Although the Carlin Corridor crosses no current leases, access through the valley could be affected for a short period during the construction of a branch rail line. The corridor also passes through areas of potential future exploration. The Crescent Valley Alternate (see Appendix J, Section J.3.1.2) passes just west of the Cortez Gold Mines. This corridor variation crosses an existing road right-of-way leading from the Gold Acres Mine to the ore mills at the Cortez mining facility. It also crosses a proposed pipeline right-of-way from the Cortez Gold Mine to the Dean Ranch. This pipeline would deliver water to the ranch (DIRS 155095-BLM 2000, all). Construction activities could deny or interfere with access to the milling

facility at Cortez. The pipeline right-of-way would have to be modified to include DOE or the property rights would have to be transferred to DOE. Impacts to the road right-of-way would be slight if access to the area's mining facilities was maintained. The pipeline could require modifications to allow the building of a rail line through the right-of-way.

The Steiner Creek Alternate passes close to and might encroach on the Simpson Park Wilderness Study Area. Construction activities in the vicinity of a wilderness study area could affect the experience in the wilderness environment.

One segment of the Carlin Corridor and the Mud Lake Alternate would encroach on the Nellis Air Force Range (also known as the Nevada Test and Training Range). The U.S. Air Force has noted the potential for safety risks of crossing lands that are hazard areas and encompass weapons safety footprints for live weapons deployment. For each of the sections that could enter the Nellis Range, DOE has identified a corridor variation that would avoid the potential land-use conflict (see Appendix J, Section J.3.1.2). If DOE decided to build and operate a branch rail line in the Carlin Corridor, it would consult with the Bureau of Land Management, the U.S. Air Force, and other affected agencies and Native American governments to help ensure that it avoided or mitigated potential land-use conflicts associated with alignment of a right-of-way. Because the Military Lands Withdrawal Act of 1999 (Public Law 106-65, 113 Stat. 885) withdraws and reserves the Nellis Air Force Range for use by the Secretary of the Air Force, the Secretary would need to concur with a decision to build and operate a branch rail line through any part of the Range.

The presence of a rail line could influence future development and land use along the railroad in the communities of Austin, Beatty, Carver's Station, Cortez, Crescent Valley, Manhattan, Round Mountain, Scottys Junction, and Tonopah (that is, zoning and land use might differ depending on the presence or absence of a railroad), as well as a potential Timbisha Shoshone community at their Trust Lands parcel near Scottys Junction.

Operations. DOE expects operations along the Carlin Corridor, including its variations, to cause fewer impacts than the construction phase of the project, even though the branch rail line would pass through areas of private ownership and a number of other unique areas (see Table 6-2 in Section 6.1.2.1). The presence of an operational rail line near the Simpson Park Wilderness Study area could detract from the wilderness experience. The operation of a branch rail line along the Bonnie Claire Alternate could limit economic development in the Timbisha Shoshone parcel and could limit the parcel's use for reservation housing by restricting access. The Bonnie Claire Alternate passes almost directly through the center of the parcel.

6.3.2.2.2.2 Carlin Rail Hydrology

Surface Water

Surface-water resources along the Carlin Corridor and its variations are discussed in Chapter 3, Section 3.2.2, and summarized in Table 6-37. As listed in the table, the number of surface-water resources in the vicinity of the corridor would change by small numbers if DOE used any of the variations. Both the Rye Patch and Oasis Valley Alternates would involve one less surface-water resource in the 400-meter (0.25-mile)-wide corridor, and a corresponding increase in the number of resources outside the corridor but within 1 kilometer (0.6 mile). As discussed in Section 6.3.2.1, impacts during construction or operations from the possible spread of construction-related materials by precipitation or intermittent runoff events, releases to surface waters, and the alteration of natural drainage patterns or runoff rates that could affect downgradient resources would be unlikely.

Flood zones identified along the Carlin Corridor and its variations are listed in Table 6-38. The Federal Emergency Management Agency maps from which DOE derived the flood zone information provided coverage for about 83 percent of the corridor's length. This corridor would cross 11 different 100-year

Table 6-37. Surface water resources along Carlin Corridor and its variations.[a,b,c]

Corridor description	Resources in 400-meter[d] corridor			Resources outside corridor within 1 kilometer[e]		
	Spring	Stream/ riparian area	Reservoir	Spring	Stream/ riparian area	Reservoir
Carlin Corridor	1	5	--[f]	10	2	1
with Wood Spring Canyon Alternate	1	5	--	8	2	1
with Steiner Creek Alternate	1	5	--	10	1	1
with Rye Patch Alternate	1	4	--	11	3	1
with Monitor Valley Option	1	5	--	9	2	--
with Gold Field Alternate	1	5	--	12	2	1
with Oasis Valley Alternate	--	5	--	11	2	1

a. Source: Reduced from tables in Chapter 3, Section 3.2.2.1.3.
b. Resources are the number of locations; that is, a general location with more than one spring was counted as one water resource.
c. Resources shown for variations are for the entire corridor with only the identified variation changed. Variations not shown (that is, Crescent Valley Alternate, Mud Lake Alternate, Bonnie Claire Alternate, and Beatty Wash Alternate) are neither associated with any identified water resources, nor would they avoid any resources along the Corridor.
d. 400 meters = about 1,300 feet.
e. 1 kilometer = 0.6 mile.
f. -- = none.

flood zones or flood-zone groups before entering the Nevada Test Site. Eight of the 10 variations would change the number of flood zones crossed but, with one exception, changes would be up or down by one. The exception would be the Monitor Valley Option, which would increase the number of 100-year flood zones crossed by four. As indicated in Section 6.3.2.1, impacts associated with altering drainage patterns or changing erosion and sedimentation rates or locations would be minor and localized.

Groundwater

Construction. The water used during construction would come largely from groundwater resources. The annual demands would be a fraction of the perennial yields of most producing aquifers (see Chapter 3, Section 3.2.2.1.3, for estimated perennial yields for the hydrographic areas over which the potential branch rail line in the Carlin Corridor passes).

The estimated amount of water needed for the construction of a branch rail line in the Carlin Corridor for soil compaction, dust control, and workforce use would be about 810,000 cubic meters (660 acre-feet) (DIRS 104914-DOE 1998, all). For planning purposes, DOE assumed that this water would come from 67 groundwater wells installed along the rail corridor. The average amount of water withdrawn from each well would be approximately 12,000 cubic meters (10 acre-feet). Most (91 percent) of the water would be used for compaction of fill material. The estimate of fill quantities for construction varies according to the variation. However, no single variation applicable to the Carlin Corridor would increase the estimate of water demand by more than 5 percent.

Chapter 3, Section 3.2.2.1.3, discusses the hydrographic areas over which the corridor would pass, their perennial yields, and whether the State of Nevada considers each a Designated Groundwater Basin. If the hydrographic area is a Designated Groundwater Basin, permitted groundwater rights approach or exceed the estimated perennial yield, depleting water resources or requiring additional administration. Table 6-39 summarizes the status of the hydrographic areas associated with the Carlin Corridor, and the approximate portion of the corridor that passes over Designated Groundwater Basins. As listed in Table 6-39, use of the Monitor Valley Option would result in an approximate 20-percent decrease in the portion of the corridor crossing Designated Groundwater Basins.

Table 6-38. 100-year flood zones crossed by the Carlin Corridor and its variations.[a,b]

Corridor portion	Crossing distance (kilometers)[c]	Flood zone feature(s)	Avoided by variation[d] (Yes or No)
Beowawe to Austin	4.0	Flood zone associated with Coyote Creek drainage (dry)	N
	1.6	Indian Creek (dry) and unnamed wash to the south	Y-1
	0.9	Unnamed Callaghan tributary, Skull and Callaghan Creeks (intermittent)	Y-3
	0.1	Rye Patch Canyon Creek (intermittent)	Y-4, 5
	1.4	Simpson Park Canyon Creek (intermittent) and Canyon Creek drainage (intermittent)	Y-4, 5
	1.4	Canyon Creek and Canyon Creek drainage (intermittent)	Y-5
Austin to Mud Lake	0.3	Peavine Creek tributary (intermittent)	Y-5
Mud Lake to Yucca Mountain	0.8	Unnamed washes to the north and south of Ralston (dry)	N
	0.3	Tolicha Wash	Y-8
	1.1	Amargosa River (wet in sections, intermittent in others)	Y-9
	0.1	Beatty Wash	Y-10
Variations			
1. Crescent Valley Alternate	2.0	Crosses Indian Creek (intermittent)	
	3.2	Crosses an unnamed wash to the south	
2. Wood Spring Alternate	None	Located to the west of the primary rail corridor	
3. Steiner Creek Alternate	4.9	Crosses Callaghan and Canyon Creeks (intermittent)	
4. Rye Patch Alternate	1.4	Crosses Canyon Creek and Canyon Creek drainage (intermittent)	
5. Monitor Valley Option[d]	0.6	Crosses Mosquito Creek (intermittent)	
	0.5	Crosses Corcoran Creek and Meadow Creek (intermittent)	
	1.5	Crosses Meadow Creek drainage; (dry)	
	0.6	Crosses Hunts Canyon Creek (intermittent)	
	0.2	Crosses Willow Creek (intermittent)	
	2.0	Crosses drainage areas approaching Mud Lake (dry)	
	5.7	Crosses drainage areas approaching Mud Lake (dry)	
	4.8	Crosses Mud Lake drainage (dry)	
6. Mud Lake Alternate	3.1	Crosses the Mud Lake flood zone	
7. Goldfield Alternate	None	Located to west of rail Corridor	
8. Bonnie Claire Alternate	1.3	Crosses an unnamed wash south of Ralston	
	0.7	Crosses Tolicha Wash (intermittent)	
9. Oasis Valley Alternate	1.0	Crosses Amargosa River (wet in segments, intermittent in others)	
10. Beatty Wash Alternate	0.1	Crosses Beatty Wash (intermittent)	

a. Areas where natural floodwater movement might be altered and where erosion and sedimentation rates and locations could change. Sources:
   1. Federal Emergency Management Agency Flood Insurance Rate Maps for Eureka, Lander, and Nye Counties, Nevada.
   2. DIRS 154961-CRWMS M&O (1998, all).

b. About 17 percent of the primary Carlin Corridor is not available on Federal Emergency Management Agency maps, due primarily to limited coverage in Esmeralda County, the Nellis Air Force Range, and the Nevada Test Site.

c. To convert kilometers to miles, multiply by 0.62137.

d. Certain 100-year flood zones can be avoided by alternate corridor segments. These are identified with a "Y" (yes) and a number representing the specific alternate(s) from the second half of the table that avoids the specific flood zone. The same flood zone might be crossed by the corridor and its variations at different locations. In such cases, the feature will be marked "Avoided" for the corridor, but will appear again for the variations.

Table 6-39. Hydrographic areas along Carlin Corridor and its variations.[a]

Corridor description	Hydrographic areas	Designated Groundwater Basins	
		Number	Percent of corridor length
Carlin Corridor	12	6	70
with Monitor Valley Option	12	5	50
with Goldfield Alternate	11	5	70
other alternates[a]	12	6	70

a. Crescent Valley, Wood Spring, Rye Patch, Steiner Creek, Mud Lake, Bonnie Claire, Oasis Valley, and Beatty Wash.

The withdrawal of about 12,000 cubic meters (10 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the corridor based on their perennial yields (Chapter 3, Section 3.2.2.1.3). However, the installation of 67 wells along the corridor would mean that many hydrographic areas would have multiple wells. As indicated in Table 6-39, about 70 percent of the length of the Carlin Corridor is in Designated Groundwater Basins, which the Nevada State Engineer's office watches carefully for groundwater depletion. This does not mean that DOE could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. Because the DOE requests would be for a short-term construction action, the State Engineer would have even more discretion. Rather than spacing the wells evenly along the corridor, DOE could use locations that would make maximum use of groundwater areas that are not Designated Groundwater Basins. With such a large portion of the corridor over these basins, however, this would mean that DOE would truck water for long distances. Another option would be to lease temporary water rights from individuals along the corridor. Obtaining a water appropriation from the State Engineer for short-term construction use or using an approved allocation would ensure no adverse effects to groundwater resources. Use of the Monitor Valley Option would decrease the portion of the corridor crossing Designated Groundwater Basins and possibly increase DOE's flexibility in obtaining water along the corridor.

As an alternative, DOE could transport water by truck to meet construction needs. The construction of a branch rail line in the Carlin Corridor would require about 43,000 tanker-truck loads of water or about 9 truckloads each day for each work camp along the corridor. Again, water obtained from permitted sources, which would be within allocations determined by the Nevada State Engineer, would not affect groundwater resources.

Operations. Operations along a completed rail line would have little impact on groundwater resources. Possible changes in recharge, if any, would be the same as those at the completion of construction.

6.3.2.2.2.3 Carlin Rail Biological Resources and Soils

Construction. The construction of a rail line in the Carlin Corridor, including its variations, would disturb approximately 19 square kilometers (4,700 acres) (Table 6-35). Areas in nine of the land-cover types identified in Nevada (DIRS 104593-CRWMS M&O 1999, pp. C1 to C5) would be affected by the construction of a branch rail line in the Carlin Corridor (Table 6-40). The analysis assumed that the types of land cover in disturbed areas outside the corridor would be the same as that within the corridor. The EIS analysis assumed that the composition of land-cover types in these areas would be similar to the cover types in the corridor. The greatest amounts of disturbance would occur in the sagebrush, salt-desert scrub, and creosote bursage land-cover types for both the Big Smoky Valley Option and Monitor Valley Option, but would involve far less than 0.01 percent of the existing area in those land-cover types. The fraction disturbed for each cover type would be very small. The disturbance would have no discernible impact on the availability of habitat for plants or animals associated with any cover type. Although some alignment variations could lead to a small increase in the total amount of land disturbed, the portion of the corridor, including its variations, in each land-cover type would be similar to that in the unvaried corridor.

About 50 kilometers (31 miles) of its length along the southern end of the corridor occurs in desert tortoise habitat. Assuming 0.06 square kilometer (15 acres) disturbed per linear kilometer of railroad, construction activities would disturb about 3 square kilometers (740 acres) of this habitat. Such activities could kill individual desert tortoises; however, the abundance of this species is low in this area (DIRS 103281-Karl 1981, pp. 76 to 92; DIRS 101914-Rautenstrauch and O'Farrell 1998, pp. 407 to 411) so losses would be few. Relocation of tortoises along the corridor prior to construction would minimize losses of individuals. The presence of a branch rail line could interfere with movement of individual tortoises. If DOE selected this corridor, it would consult with the Fish and Wildlife Service (under Section 7 of the Endangered Species Act) regarding this species, and would implement all terms and conditions required by the Fish and Wildlife Service.

Table 6-40. Maximum area disturbed (square kilometers)[a] in each land-cover type for the Carlin Corridor.[b,c]

	Big Smoky Valley Option		Monitor Valley Option			
Land-cover type	Percent of corridor length	Land area	Percent of corridor length	Land area	Area in Nevada	Percent disturbed
Agriculture	0	0	0	0	5,200	0
Blackbrush	0.1	0.02	0.1	0.02	9,900	<0.001
Creosote-bursage	5.9	1.1	5.9	1.2	15,000	0.007
Grassland	0	0	0	0	2,800	0
Greasewood	6.4	1.2	4.3	0.86	9,500	0.013
Hopsage	1.9	0.37	1.9	0.38	630	0.057
Juniper	0	0	0	0	1,400	0
Mojave mixed scrub	4.5	0.87	4.5	0.9	5,600	0.015
Pinyon-juniper	0.6	0.12	0.6	0.12	15,000	<0.001
Playa	0	0	0	0	7,000	0
Sagebrush	24.9	4.8	43.1	8.7	67,000	0.012
Sagebrush/grassland	2.3	0.44	5.9	1.2	52,000	0.002
Salt desert scrub	53.4	10	33.7	6.8	58,000	0.018
Urban	ND[d]	ND	ND	ND	2,400	ND
Total[e]	100	19.3	100	20.1	250,000	N/A[f]

a. To convert square kilometers to acres, multiply by 247.1.
b. Based on the proportion of the route in each land-cover type; percent disturbed was based on the variation with the greatest disturbance within a particular land-cover type. Percentages add to more than 100 because maximum values were used.
c. Source: DIRS 104593-CRWMS M&O (1999, Appendix D).
d. ND = not determined.
e. Totals might differ from sums of values due to rounding.
f. N/A = not applicable.

Three other sensitive species occur in the 400-meter- (0.25-mile)-wide corridor: one population of a sensitive plant species, the Nevada sanddune beardtongue; and one population each of two sensitive animal species (a ferruginous hawk nesting area and the San Antonio pocket gopher). Use of the Monitor Valley Option rather than the Big Smoky Valley Option would avoid the pocket gopher population, and the Steiner Creek Alternate would avoid the hawk nesting area (Appendix J, Section J.3.1.2 lists corridor variations). These populations could be disturbed during construction activities. Adverse impacts to the hawk nesting area could be long term because periodic disturbances associated with the presence of a railroad could cause the hawks to abandon the area.

At least three populations of three sensitive plant species occur outside the corridor, but within 5 kilometers (3 miles). Use of the Monitor Valley Option would avoid one of these populations. DOE anticipates no impacts to these populations because land disturbance would not extend to these areas and changes in the aquatic or soil environment in these areas as a result of construction or long-term presence of a railroad would be unlikely.

Fourteen populations of eight sensitive animal species occur outside the corridor, but within 5 kilometers (3 miles). Ten populations of five of these species are associated with springs or aquatic habitat. These populations would not be affected by construction activities due to their distance from the corridor. The Monitor Valley Option would avoid one population each of two of these species.

This rail corridor, including its variations, crosses seven areas designated as game habitat and six areas designated as wild horse and burro management areas (see Chapter 3, Section 3.2.2.1.4). Construction activities would reduce habitat in these areas. Wild horses, burros, and game animals near these areas during construction would be disturbed, and their migration routes could be disrupted. In addition, there are 17 areas designated as game habitat outside the 400-meter (0.25-mile)-wide corridor but within 5 kilometers (3 miles). Larger game animals occupy large home ranges and could easily traverse the distance between the designated habitat and the proposed corridor. Four of these areas are associated

with sage grouse (1 nesting and 3 strutting) and probably would not be affected by construction of the rail line.

One group of springs and three to four stream or riparian areas are within the 400-meter (0.25-mile)-wide corridor, and its variations (Table 6-37). Although no formal delineations have been made, these areas may be jurisdictional wetlands or other waters of the United States. Construction could increase sedimentation in these areas. In addition, the corridor crosses a number of ephemeral streams that may be classified as waters of the United States. DOE would work with the U.S. Army Corps of Engineers to minimize impacts to these areas and would obtain individual or regional permits if necessary. DOE anticipates some changes to local drainage along a branch rail line and would design the rail line to accommodate existing drainage patterns.

In addition, as many as 60 known springs and 6 riparian areas occur outside the corridor, but within 5 kilometers (3 miles), including the corridor variations. Nine known populations of four sensitive animal species are associated with these aquatic resources. DOE anticipates no impacts to these populations because these areas would not be disturbed during construction or by the long-term presence of a railroad. Although there are differences in the number of springs or riparian areas that some corridor variations would avoid, the Monitor Valley Option would avoid 13 of the springs and four of the riparian areas that are outside of the corridor but within 5 kilometers.

Construction activities would temporarily disturb about 19 square kilometers (4,700 acres) of soils in and adjacent to the corridor. The impacts to soils of disturbing 19 square kilometers (4,700 acres) along the 520-kilometer (323-mile)-long corridor would be transitory and small. However, several soil characteristics could influence construction activities and the amount of disturbed area. Soils susceptible to water or wind erosion occur along much of the corridor and its variations as do soils exhibiting relatively high shrink-swell characteristics (see Chapter 3, Section 3.2.2.1.4). Disturbance of erodible soils could lead to increased silt loads in water courses or increased soil transport by wind. Erosion control during construction, and revegetation or other means of soil stabilization after construction, would minimize these concerns. The presence of soils with poor (that is, high) shrink-swell characteristics could influence the amount of area disturbed by construction if soils from outside areas had to be brought in for replacement or mixing with native soil.

As stated in Chapter 3, Section 3.2.2.1.4, potential variations identified for the Carlin Corridor could avoid some biological resources, as listed in Table 6-41.

6.3.2.2.2.4 Carlin Rail Cultural Resources

Construction. This section discusses the segment of the Carlin Corridor from the existing Union Pacific main line railroad near Beowawe in north-central Nevada to its junction with the Caliente Corridor, northwest of Mud Lake. The remainder of the corridor is the same as the final segment of the Caliente Corridor from that point to the proposed repository; impact potential along that segment is discussed in Section 6.3.2.2.1.4.

Archaeological site file searches for the overall Carlin Corridor, including its variations (see Appendix J, Section J.3.1.2), resulted in the identification of 110 known sites (see Chapter 3, Section 3.2.2.1.5), 47 of which are eligible or potentially eligible for inclusion in the *National Register of Historic Places*. The segment of the Carlin Corridor north of the junction point with the Caliente Corridor crosses or passes through several potentially important areas for archaeological and historical sites. Based on currently available information (DIRS 155826-Nickens and Hartwell 2001, p. 27), each of the valleys through which the corridor and its variations pass—Crescent, Grass, Big Smoky, Monitor, and Ralston—have medium to high potential for prehistoric and historic Native American sites. Late 19th- and early 20th-century Western Shoshone village sites are collocated with the historic Grass Valley Ranch; similar situations might occur at other historic ranches the Corridor passes.

Table 6-41. Biological resources avoided by Carlin Corridor variations.[a]

	Occurrence of resource			
	For unvaried segment of corridor		Occurrence avoided by variation	
Alignment variation resource	In corridor[b]	Within 5 km[c]	In corridor	Within 5 km
Steiner Creek Variation				
Sensitive species–ferruginous hawk nesting	1	2	1	0
Game habitat–sage grouse strutting	2	3	1	1
Springs or groups of springs	4	59	0	2
Riparian areas	3	7	2	1
Rye Patch Variation				
Springs or groups of springs	4	59	1	0
Riparian areas	3	7	1	0
Monitor Valley Variation				
Sensitive species				
Big Smoky Valley speckled dace	0	1	0	1
Crescent Dune aegialian scarab	0	1	0	1
Nevada sanddune beardtongue	1	1	0	1
San Antonio pocket gopher	1	0	1	0
Game habitat				
Pronghorn–year round	1	0	1	0
Waterfowl	0	1	0	1
Springs or groups of springs	4	59	0	13
Riparian areas	3	7	0	4

a. Variations listed are those that would result in the avoidance of biological resources along the corridor.
b. In the corridor [or springs within 400 meters (0.25 mile)], but avoided by the corridor variation.
c. Within 5 kilometers (3 miles) of the corridor, but more than 5 kilometers from the corridor variation.

Between Beowawe and U.S. Highway 50, the Carlin Corridor intersects with the California Emigrant Trail and the Pony Express Trail, both designated by Congress as *National Historic Trails* under the National Trails System Act, and the historic Pacific Telegraph Line, Butterfield Overland Mail and Stage route, and Lincoln Highway routes (DIRS 155826-Nickens and Hartwell 2001, p. 15). None of these resources has been evaluated for eligibility for the *National Register of Historic Places*, although the segment of the Pony Express Trail intersected by the Carlin Corridor, Rye Patch Alternate, and Monitor Valley Option has been designated a High Potential segment by the National Park Service. The Monitor Valley Option passes within view of the Belmont Historic District at the southern end of the valley, and to the south in Ralston Valley passes close to known but unrecorded and unevaluated archaeological sites, as well as the former bombing range for the Tonopah Army Air Station.

Construction of a branch rail line in this corridor could affect two historic Native American cemeteries, one in Crescent Valley and the other in Grass Valley (DIRS 155826-Nickens and Hartwell 2001, p. 27). The corridor passes within 3 kilometers (2 miles) of another cemetery southeast of Beowawe that local Western Shoshone families still use. Crescent Valley itself is part of the disputed Western Shoshone homelands, and grazing rights throughout the valley have been the subject of litigation between local Western Shoshone ranchers and the Bureau of Land Management.

Operations. As stated in Section 6.3.2.1, additional impacts to these resources during the operation of the branch rail line would be unlikely.

6.3.2.2.2.5 Carlin Rail Occupational and Public Health and Safety

Construction. Industrial safety impacts on workers from the construction and use of the Carlin branch rail line would be small (see Table 6-42). The analysis evaluated the potential for impacts in terms of

Table 6-42. Impacts to workers from industrial hazards during rail construction and operations for the Carlin Corridor.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	99	95
Lost workday cases	49	52
Fatalities	0.14	0.26
Noninvolved workers		
Total recordable cases	5.9	5.4
Lost workday cases	2.2	2.0
Fatalities	0.006	0.006
Totals[d]		
Total recordable cases	110	100
Lost workday cases	51	54
Fatalities	0.14	0.27

a. Totals for 46 months for construction.
b. Totals for 24 years for operations.
c. Total recordable cases includes injury and illness.
d. Totals might differ from sums due to rounding.

total reportable cases of injury, lost workday cases, and fatalities to workers from construction and operation activities.

The analysis also evaluated traffic fatality impacts that would occur during the moving of equipment and materials for construction, worker commutes to and from construction sites, and transport of water to construction sites if wells were not available. Table 6-43 lists these results.

Operations. Incident-free radiological impacts would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste in the Carlin Corridor. Table 6-44 lists the incident-free impacts, which would include transportation along the Carlin Corridor and transportation along railways in Nevada that led to a Carlin branch line. The table includes the impacts of 1,079 legal-weight truck shipments from commercial sites that would not have the capability to load rail casks while operational.

Table 6-43. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Carlin Corridor.

Activity	Kilometers[a]	Traffic fatalities	Emissions fatalities
Construction[b]			
Material delivery vehicles	19,000,000	0.3	0.04
Commuting workers	76,000,000	0.8	0.10
Subtotals	*95,000,000*	*1.1*	*0.14*
Operations[c]			
Commuting workers	68,000,000	0.7	0.09
Totals	*160,000,000*	*1.8*	*0.23*

a. To convert kilometers to miles, multiply by 0.62137.
b. Totals for 46 months for construction.
c. Totals for 24 years for operations.

Table 6-44. Health impacts from incident-free Nevada transportation for the Carlin Corridor.[a]

Category	Legal-weight truck shipments	Rail shipments	Totals[b]
Involved workers			
Collective dose (person-rem)	38	940	980
Estimated latent cancer fatalities	0.02	0.38	0.39
Public			
Collective dose (person-rem)	7	32	38
Estimated latent cancer fatalities	0.003	0.02	0.02
Estimated vehicle emission-related fatalities	0.002	0.017	0.018

a. Impacts are totals for 24 years.
b. Totals might differ from sums of values due to rounding.

6.3.2.2.2.6 Carlin Rail Socioeconomics

The following paragraphs discuss potential socioeconomic impacts associated with the construction of a branch rail line in the Carlin Corridor and with the operation of the line.

The Carlin Corridor passes through Lander County, very small portions of Eureka and Esmeralda Counties, and Nye County. DOE considered potential socioeconomic impacts in Lander, Eureka, and Esmeralda Counties collectively as part of the Rest of Nevada, the portion of the State outside the region of influence.

Construction. The length of the Carlin Corridor, 520 kilometers (323 miles), would determine the number of workers required. The construction of a branch rail line in this corridor would require workers laboring for 2.5 million hours or 1,230 worker-years during the 46-month construction period (DIRS 154822-CRWMS M&O 1998, all). During the work week, the workers would commute to and temporarily live in five construction camps.

Employment

DOE anticipates that total (direct and indirect) employment in Nevada attributable to the construction of a Carlin branch rail line would peak in the first year of construction, 2006, at about 783 jobs, 85 percent of which would be in the region of influence. The increase in employment represents less than 1 percent of the baseline for employment in each of the three counties in the region of influence (Clark, Nye, and Lincoln Counties) and in the Rest of Nevada. Clark County would supply about 574 workers, Nye County 95, and Lincoln County 1. The balance of the workers, 113, would come from the Rest of Nevada. Employment of Carlin Corridor construction workers and some indirect support workers would end in 2009. As a result, the projected total growth of 19,915 jobs (2009 to 2010) in the State of Nevada would be reduced by approximately 700. The expected 14,886 additional jobs in Clark County would be reduced by 690, and the expected growth of 330 jobs in Nye County would be reduced by 46. The expected growth of 24 jobs in Lincoln County would be unaffected. The expected 4,675 additional jobs in the Nevada counties outside the region of influence would be supplemented by 37. DOE anticipates that project-related workers not moving to Carlin Corridor operational jobs would be absorbed in other work in the State. These changes in employment would represent less than 1 percent of the applicable baselines.

Population

Population increases in Nevada attributable to the construction of a Carlin rail line, which would lag increases in employment, would peak 2 years later in 2009 at about 728 persons. About 683 persons, or 94 percent of the expected additional residents, would live in the region of influence. Clark County would gain about 625 residents, Nye County would gain about 57 residents, and Lincoln County would gain 1. The Rest of Nevada, would gain approximately 44 residents. Because Clark County has a larger population, the expected impact from the change in population would be less than 1 percent. The impacts of projected increases in population in Nye and Lincoln Counties, and in the Rest of Nevada would also be less than 1 percent. Because the increases in population resulting from the construction of a rail line in the Carlin Corridor would be small and transient in Clark, Nye, and Lincoln Counties, and in the Rest of Nevada, impacts to schools or housing would be unlikely.

Economic Measures

The expected peak annual changes in economic measures in the State due to the construction of a branch rail line in the Carlin Corridor would be increases of $21.4 million in real disposable income in 2009; $36.0 million in Gross Regional Product during 2007; and $2.5 million in State and local expenditures in 2009 with 90 percent concentrated in the region of influence. More than 90 percent of the increase in Gross Regional Product and real disposable income would be generated in Clark County. Clark County would absorb approximately 83 percent of the increases in State and local government expenditures. About 3 percent of the increase in Gross Regional Product and real disposable income would be generated in Nye County as would 7 percent of the expenditures by State and local governments. Because there would be virtually no change to employment or population in Lincoln County attributable to a rail line in the Carlin Corridor, there would be virtually no impact or change to Gross Regional

Product, real disposable income, or expenditures by State and local government. (Dollar values reported in this section are in 2001 dollars unless otherwise stated.)

Construction-related impacts to employment, population, real disposable income, Gross Regional Product, and State and local government expenditures for a branch rail line in the Carlin Corridor would be less than 1 percent of the applicable baselines for Clark, Nye, and Lincoln Counties and the Rest of Nevada.

Transition and Operations Period. In the period from 2010 to 2012, the State of Nevada would have an average of 27 fewer jobs. For perspective, the State of Nevada would have an average employment of about 1.5 million during this same period. Slightly slower growth would be confined to Clark County from 2010 to 2016. Growth in employment in Clark County during this transitional period would be approximately 66 fewer jobs than if DOE did not build a branch rail line in the Carlin Corridor. The Lincoln County employment baseline during this period would average about 75,000 jobs. During this period, Nye County would gain 5 jobs. There would be no change in employment in Lincoln County. A Carlin branch rail line would accelerate the rate of growth in the region's employment starting in 2016. The area outside the region of influence, the Rest of Nevada, would gain approximately 78 project-related jobs during this transition period. A Carlin rail line would contribute to growth in residential populations in and outside the region of influence throughout the transition period and to the employment base in the State after 2012.

Employment and Population

Estimated direct employment for operations in the Carlin Corridor would be 47 workers during the 24 years of operations. The change in total employment would average about 86 jobs in Nevada. DOE assumed that 6 of the additional workers would be employed in Clark County, about 6 in Nye County, and none in Lincoln County. The rest of the individuals would work in the Rest of Nevada, primarily in Elko County. The average annual addition to population in the State attributable to a branch rail line in the Carlin Corridor would be about 294 persons. About 160 of these persons would live in Clark County, 31 in Nye County, and none in Lincoln County. The rest of the individuals would live elsewhere within the State. DOE assumed that half of the Carlin rail operational personnel (approximately 24 directly employed individuals) would live at each end of the branch rail line. Rail operations employees and indirectly employed individuals who would live near the Beowawe end of the rail line would live in or near the Town of Elko in Elko County. Impacts due to changes in population and employment attributable to a Carlin rail line in Elko County, which had an estimated 2000 population of about 45,500 and about 21,100 jobs, would be less than 0.5 percent. Because impacts from increases in population and employment in each county would be small, impacts to schools or housing would be unlikely. The average annual impact, in relation to the baselines for population and employment in Clark, Nye, and Lincoln Counties and the Rest of Nevada, would be less than 1 percent.

Economic Measures

From 2010 until 2033 the estimated average annual increase in Nevada from operating a branch rail line in the Carlin Corridor in real disposable income would be $5.7 million. Approximately 33 percent would be generated in the region of influence, and the balance would be generated primarily in Elko County. The average increase in annual Gross Regional Product in the State attributable to a Carlin rail line would be about $5.3 million, of which $4.9 million would come from goods and services outside the region of influence. On average, during operation of a Carlin rail line, changes in real disposable income would exceed changes in Gross Regional Product. The increase in annual State and local government expenditures would be about $1.2 million, much lower than those reported above for construction. Approximately 46 percent of these additional expenditures would come from outside the region of influence. The impact of changes in Gross Regional Product, real disposable income, and expenditures by State and local governments would be less then 1 percent for Clark, Nye, and Lincoln Counties and for the Rest of Nevada.

DOE performed a detailed analysis for the Carlin rail line because of its length. The results of this analysis are representative of the potential variations (options and alternates) listed in Appendix J, Section J.3.1.2. The lengths of the variations are similar to those listed in Table 6-36.

6.3.2.2.2.7 Carlin Rail Noise and Vibration

Over most of its length, the Carlin Corridor, including the Monitor Valley and Big Smoky Valley Options, passes through undeveloped land managed by the Bureau of Land Management. Human inhabitants of this land consist primarily of isolated ranchers and persons involved with outdoor recreation. DOE identified 12 communities along or near the Carlin Corridor (including its Monitor Valley and Big Smoky Valley Options) and estimated the distances from a branch rail line to the community's nearest boundary (Table 6-45). The estimated maximum railroad noise from a two-locomotive train would occur at the boundary of the community. Estimated noise levels would not exceed the 60-dBA benchmark for residential communities during daytime hours. Communities within 1 kilometer (0.6 mile) of the rail line would experience single episodes of noise higher than the nighttime 50-dBA benchmark. A limitation of 10 dBA above the benchmark is allowable if its duration is less than 5 minutes in an hour (Washington Administrative Code-170-60). The estimated duration of noise that peaked at 57 dBA would be less than 2 minutes in communities 1 kilometer from the rail line at a speed of 50 kilometers (30 miles) per hour. For distances of 5 kilometers (3 miles) or greater, the estimate of 26 dBA would be subject to large uncertainty.

Table 6-45. Estimated propagation of noise (dBA) from the operation of a waste transport train with two locomotives in communities near the Carlin Corridor.

Corridor/community	Distance (kilometers)[a]	Estimated noise (dBA)[b]
Carlin Corridor		
Beowawe	3.2[c]	32
Crescent Valley	1.9	44
Austin	16	< 26
Big Smoky Valley Option		
Carver	1.0	57
Round Mountain	1.0	57
Manhattan	1.0	57
Monitor Valley Option		
Belmont	2.0	43
Tonopah (east alignment)	8[c]	< 26[d]
Tonopah (west alignment)	13[c]	< 26
Goldfield	6.0	< 26
Beatty	9.6[c]	< 26
Amargosa Valley	9.6[c]	< 26

a. To convert kilometers to miles, multiply by 0.62137.
b. Estimated values do not include noise loss due to interactions with the ground that could account for decreases in estimated noise levels of from 10 to 20 dBA at 100 meters (330 feet) from the tracks.
c. Noise estimates at distances greater than 2.0 kilometers (1.2 miles) have large uncertainty.
d. At these distances, the A-weighted sound pressure level is dominated by lower frequencies (lower than 63 Hertz) and would not be distinguishable from normal background levels of noise.

In addition to passing near communities, the variations of the Carlin Corridor pass through areas with farms and ranches. Therefore, some rural residences could fall in the region of influence for noise. The corridor and its 10 variations (see Appendix J, Section J.3.1.2) are at least 1 kilometer (0.6 mile) or more from every town along its length. The noise from trains would not exceed daytime noise standards for residential areas (60 dBA) more than 1 kilometer from a branch rail line. Because a Carlin rail line would pass near some communities, there would be a potential for noise impacts from both construction and operations. As discussed in Section 6.3.2.1, in areas where a branch rail line or variation passed near a

community, train speeds could be limited to the extent necessary to ensure that noise was below levels listed in accepted noise standards.

The Carlin Corridor passes within 1.9 kilometers (1.2 miles) of the border of the Timbisha Shoshone Trust Lands parcel. The Bonnie Claire Alternate of the corridor passes through 4.1 kilometers (2.5 miles) of the Timbisha Shoshone Trust Lands parcel near the intersection of State Route 267 and U.S. Highway 95. Noise levels from trains passing through the parcel would be at 90 dBA at 15 meters (49 feet) for the Bonnie Claire Alternate. At the closest point of the Carlin Corridor, the estimated noise levels would be 44 dBA.

The estimated population residing within 2 kilometers (1.25 miles) of the Carlin Corridor in 2035 would be about 3,200 persons. The potential for human annoyance would be small.

Vibration. There are no known ruins of cultural significance along the Carlin Corridor. A branch rail line in the corridor or its variations would be distant from historic structures and buildings, so vibration impacts to such structures would be unlikely. The small number of trips (three per day) and the small train size would result in low levels of rail-induced ground vibration.

6.3.2.2.2.8 Carlin Rail Utilities, Energy, and Materials

Table 6-46 lists the projected use of fossil fuels and other materials in the construction of a Carlin branch rail line.

Table 6-46. Construction utilities, energy, and materials for a Carlin branch rail line.

Length (kilometers)[a]	Diesel fuel use (million liters)[b]	Gasoline use (thousand liters)	Steel (thousand metric tons)[c]	Concrete (thousand metric tons)
510 - 540	39 - 41	790 - 840	71 - 75	400 - 420

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.

6.3.2.2.3 *Caliente-Chalk Mountain Rail Corridor Implementing Alternative*

The Caliente-Chalk Mountain Corridor is identical to the Caliente Corridor until it reaches the northern boundary of the Nellis Air Force Range. At this point the Caliente-Chalk Mountain Corridor turns south through the Nellis Air Force Range and the Nevada Test Site to the Yucca Mountain site. Figure 6-17 shows this corridor along with possible variations identified by engineering studies (DIRS 154822-CRWMS M&O 1998, all). The corridor variations provide flexibility in addressing engineering, land-use, or environmental resource issues that could arise in a future survey along the corridor. This section addresses impacts that would occur along the corridor shown in Figure 6-17. With the exception of differences identified in Appendix J, Section J.3.1.2, the impacts would be generally the same among the possible corridor variations. The corridor is 345 kilometers (214 miles) long from its link at the Union Pacific railroad near Caliente to Yucca Mountain. Variations of the route range from 340 to 380 kilometers (210 to 240 miles).

The construction of a branch rail line in the corridor would require approximately 43 months. Construction would take place simultaneously at a number of locations. An estimated four construction camps would be established at roughly equal distances along the corridor. These camps would provide temporary living accommodations for construction workers and construction support facilities. A train would take about 8 hours to travel from the junction with the Union Pacific mainline to a Yucca Mountain Repository on a Caliente-Chalk Mountain branch rail line (DIRS 101214-CRWMS M&O 1996, Volume 1, Section 4, Branch Line Operations Plan). The estimated life-cycle cost to construct and operate a branch rail line in the Caliente-Chalk Mountain Corridor would be $622 million in 2001 dollars.

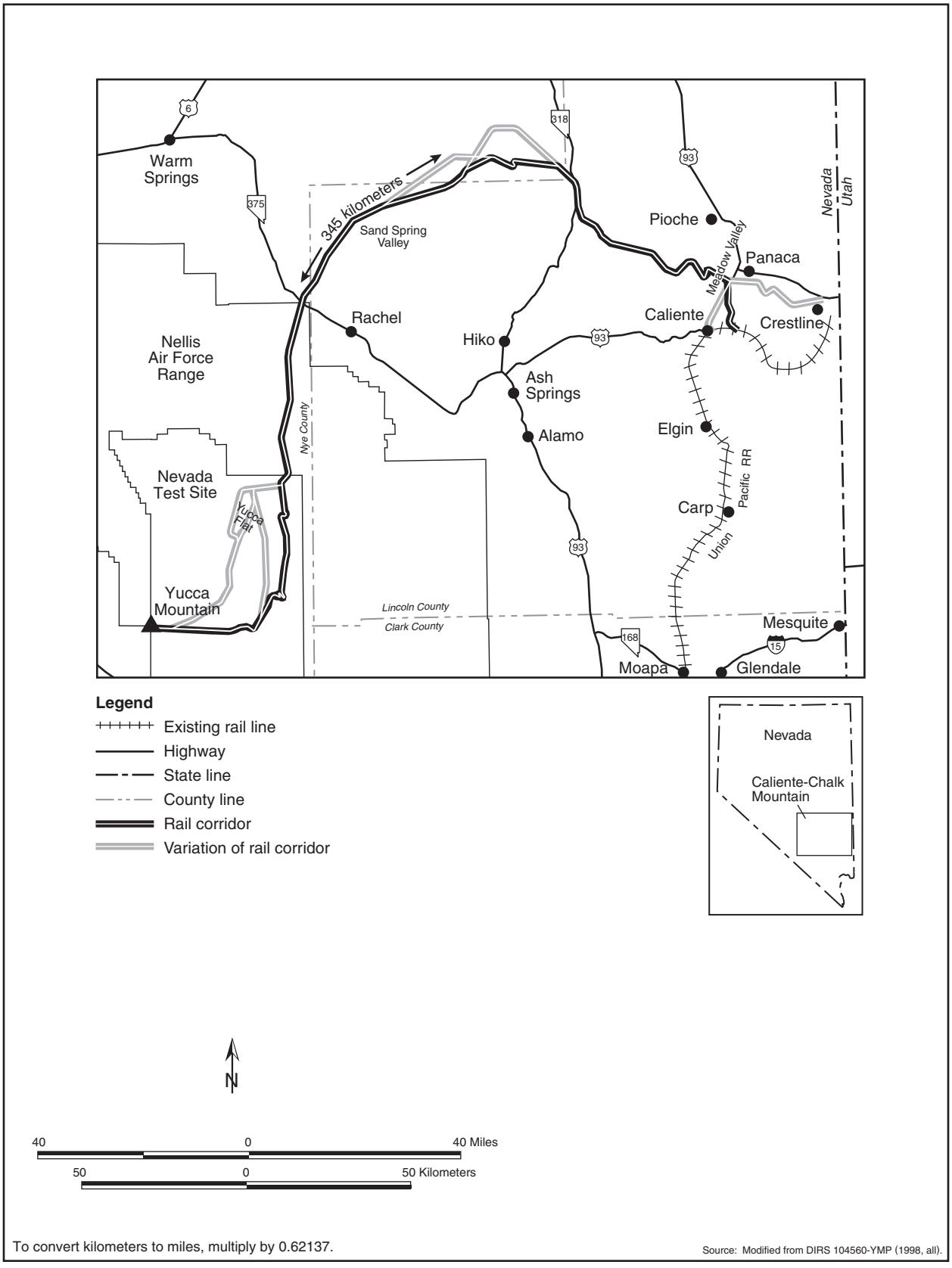


Figure 6-17. Caliente-Chalk Mountain Corridor.

The following sections address impacts that would occur to land use; biological resources and soils; cultural resources; hydrology including surface water and groundwater; occupational and public health and safety; socioeconomics; noise and vibration; and utilities, energy, and materials. Impacts that would occur to air quality, aesthetics, and waste management would be the same as those discussed in Section 6.3.2.1 and are, therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

6.3.2.2.3.1 Caliente-Chalk Mountain Rail Land Use and Ownership

Construction. Table 6-47 summarizes the amount of land required for the Caliente-Chalk Mountain corridor, its ownership, and the estimated amount of land that would be disturbed. Table 6-48 summarizes the amount of land required for the Caliente-Chalk Mountain corridor variations and its ownership.

Table 6-47. Land use in the Caliente-Chalk Mountain Corridor.[a]

Factor	Corridor (percent)	Range due to variations
Corridor length (kilometers)[b]	345	344 - 382
Land area in 400-meter[c]*-wide corridor (square kilometers)*[d]	138 (100)	138 - 153
Land ownership in 400-meter-wide corridor (square kilometers)		
Bureau of Land Management	78 (56)[e]	77.4 - 88.5
Air Force	21.5 (16)	21.5 - 21.5
DOE	37.8 (27)	31.5 - 37.8
Private	0.8 (0.6)	0.8 - 1.1
Other	None	None
Land area in 60-meter[f] *right-of-way (square kilometers)*	20.7	20.6 - 22.9
Disturbed land (square kilometers)		
Inside 60-meter right-of-way	9.6	9.6 - 10.6
Outside 60-meter right-of-way	3	3 - 3.4

a. Source: DIRS 155549-Skorska (2001, all).
b. To convert kilometers to miles, multiply by 0.62137.
c. 400 meters = about 0.25 mile.
d. To convert square kilometers to acres, multiply by 247.1.
e. Percentages do not total 100 due to rounding.
f. 60 meters = 200 feet.

The Caliente-Chalk Mountain Corridor would involve several road, power line, and utility rights-of-way before it entered the Nellis Air Force Range west of Groom Mountain and then the Nevada Test Site. The rights-of-way are similar to those discussed in relation to the Caliente Corridor and therefore the land-use impacts for this section of the corridor would be similar (see Sections 6.3.2.1 and 6.3.2.2.1). South of Rachel, Nevada the corridor crosses an additional road right-of-way (DIRS 104993-CRWMS M&O 1999, Table 5, p. 18). Variations of the corridor, as indicated in Appendix J, Section J.3.1.2, provide flexibility to address engineering, land use, or environmental constraints. Included are variations identified to provide flexibility to circumvent Test Site surface areas and associated facilities and radiologically contaminated areas. The corridor would also cross five oil and gas leases and three grazing allotments (Highland Peak, Bennett Springs, and Black Canyon). Many of the impacts along the Caliente-Chalk Mountain Corridor would be similar to those described for the Caliente Corridor (see Section 6.3.2.2.1) or are common to all five rail corridors as discussed in Section 6.3.2.1. The following paragraphs discuss impacts unique to the Caliente-Chalk Mountain Corridor.

Table 6-48. Possible variations in the Caliente-Chalk Mountain Corridor.[a]

Variation	Length (kilometers)[b]	Land area in variation (square kilometers)[c]	Land ownership [square kilometers (percent)]		
			Bureau of Land Management	Private	DOE
Eccles Option	16.7	6.7	6.3 (95)	0.4 (5)	--[e]
Caliente Option	17.2	6.9	6.21 (90)	0.69 (10)	--
Crestline Option	37.8	15.1	14.5 (95.9)	0.6 (4.1)	--
White River Alternate	47.5	19	18.98 (99.9)	0.02 (<0.1)	--
Garden Valley Alternate	37.7	15.1	15.1 (100)	--	--
Orange Blossom Road Option	85.9	34.4	--	--	34.4 (100)
Topopah Option	78.4	31.4	--	--	31.4 (100)
Topopah Option with Mine Mountain Alternate	77.8	31.1	--	--	31.1 (100)
Topopah Option with Area 4	72.1	28.8	--	--	28.8 (100)
Mercury Highway Option	52.3	20.9	--	--	20.9 (100)

a. Source: DIRS 155549-Skorska (2001, all).
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert square kilometers to acres, multiply by 247.1.
d. NA = not applicable; the Eccles Option and Orange Blossom Road Option lengths are included in the overall corridor length.
e. -- = none.

The Caliente-Chalk Mountain Corridor passes just east of the Weepah Springs Wilderness Study Area and just north of the Worthington Mountains Wilderness Study Area. The corridor involves land controlled by the Nellis Air Force Range (also known as the Nevada Test and Training Range) and, according to the Air Force, would affect Range operations. Because the Military Lands Withdrawal Act of 1999 (Public Law 106-65, 113 Stat. 885) withdraws and reserves the Nellis Air Force Range for use by the Secretary of the Air Force, the Secretary would need to concur with a decision to build and operate a branch rail line through any part of the Range before DOE could build and operate this line.

Operations. DOE expects operations along the Caliente-Chalk Mountain Corridor to cause smaller impacts than the construction phase of the project.

The Air Force has identified national security issues related to a Chalk Mountain route (DIRS 104887-Henderson 1997, all), citing interference with Nellis Air Force Range testing and training activities. In response to Air Force concerns, DOE regards the route as a "non-preferred alternative."

6.3.2.2.3.2 Caliente-Chalk Mountain Rail Hydrology

Surface Water

Chapter 3, Section 3.2.2.1.3, discusses surface-water resources along the Caliente-Chalk Mountain Corridor; Table 6-49 summarizes these resources. The use of corridor variations could result in changes to the number of surface-water resources in the vicinity of the corridor. However, the changes would be primarily to the number of resources outside, but within 1 kilometer (0.6 mile), of the corridor. As discussed in Section 6.3.2.1, impacts during construction or operations from the possible spread of construction-related materials by precipitation or intermittent runoff events, releases to surface waters, and the alteration of natural drainage patterns or runoff rates that could affect downgradient resources would be unlikely.

Table 6-50 lists flood zones identified along the Caliente-Chalk Mountain Corridor and its variations. This corridor would cross at least three 100-year flood zones or flood-zone groups before entering the Nellis Air Force Range. Two of the four variations would change the number of flood zones crossed by one (up or down). The low number of flood zones identified for the Caliente-Chalk Mountain Corridor must be qualified by the fact that the Federal Emergency Management Agency maps, from which DOE

Table 6-49. Surface-water resources along Caliente-Chalk Mountain Corridor and its variations.[a,b,c]

Corridor description	Resources in 400-meter[d] corridor			Resources outside corridor within 1 kilometer[e]		
	Spring	Stream/ riparian area	Reservoir	Spring	Stream/ riparian area	Reservoir
Caliente-Chalk Mountain Corridor	--[f]	2	--	5	--	--
with Crestline Option	--	2	--	7	--	--
with Caliente Option	1	2	--	7	--	--
with Topopah Option	--	2	--	4	--	--
with Topopah-Area 4 Alternate	--	2	--	3	--	--
with Topopah-Mine Mountain Alternate	--	2	--	4	--	--

a. Source: Reduced from table in Chapter 3, Section 3.2.2.1.3.
b. Resources are the number of locations; that is, DOE counted a general location with more than one spring as one water resource.
c. Resources listed for variations are for the entire corridor with only the identified variations changed. Variations not listed (White River Alternate, Garden Valley Alternate, Mercury Highway Connection, Orange Blossom Road Option) are not associated with identified water resources, nor would they avoid resources along the corridor.
d. 400 meters = about 0.25 mile.
e. 1 kilometer = about 0.6 mile.
f. -- = none.

derived the flood zone information, provided coverage for only about 10 percent of the corridor length. As indicated in Section 6.3.2.1, impacts associated with altering drainage patterns or changing erosion and sedimentation rates or locations would be minor and localized.

Groundwater

Construction. The water used during construction would come largely from groundwater resources. The annual demands would be a fraction of the perennial yields of most producing aquifers (Chapter 3, Section 3.2.2.1.3, discusses estimated perennial yields for the hydrographic areas over which the Caliente-Chalk Mountain Corridor passes).

The estimated amount of water needed for construction of a branch rail line in the corridor for soil compaction, dust control, and workforce use would be about 594,000 cubic meters (480 acre-feet) (DIRS 104914-DOE 1998, all). For planning purposes, DOE assumed that this water would come from 43 wells installed along the corridor. The average amount of water withdrawn from each well would be approximately 14,000 cubic meters (11 acre-feet). DOE would use most (90 percent) of the water for compaction of fill material, and the estimate of fill quantities needed for construction would vary if the Department used variations. Use of either the Topopah or Mercury Highway Options on the Nevada Test Site would involve the largest increase in fill material and could increase the total water needed for this corridor by as much as 16 percent.

Chapter 3, Section 3.2.2.1.3, discusses the hydrographic areas over which the corridor would pass, their perennial yields, and if the State of Nevada considers each a Designated Groundwater Basin. If the hydrographic area is a Designated Groundwater Basin, permitted groundwater rights approach or exceed the estimated perennial yield, depleting the basin and water resources or requiring additional administration. Table 6-51 summarizes the status of the hydrographic areas associated with the Caliente-Chalk Mountain Corridor and the approximate portion of the corridor that passes over Designated Groundwater Basins. Use of the variations (Caliente Option, Crestline Option, White River Alternate, Garden Valley Alternate, Mercury Highway Option, Topopah Option, Mine Mountain Alternate, Orange Blossom Road Option, and Area 4 Alternate) would change the number of hydrographic areas crossed, but would have no effect on the portion of the corridor crossing Designated Groundwater Basins.

Table 6-50. 100-year flood zones crossed by the Caliente-Chalk Mountain Corridor and its variations.[a,b]

Corridor portion	Crossing distance (kilometers)[c]	Flood zone feature(s)	Avoided by variation[d] (yes or no)
Eccles Siding to Meadow Valley	0.2[e]	Clover Creek (intermittent)	Y-1
	0.8[e]	Meadow Valley Wash (wet)	Y-1,2
Meadow Valley Wash to Sand Spring Valley	0.5[e]	White River (intermittent)	N
Sand Spring Valley to Yucca Mountain	--[f,g]	Not available	
Variations			
1. Crestline Option	0.8	Crosses Meadow Valley Wash (wet)	
2. Caliente Option	0.8	Crosses Meadow Valley Wash (wet)	
	0.2	Crosses Clover Creek (intermittent)	
	0.9	Crosses Meadow Valley Wash (wet) three times, rail corridor runs adjacent to Meadow Valley Wash. Passes in and out of flood zone	
3. White River Alternate	None	Located to the north of the corridor	
4. Garden Valley Alternate	None	Located to the north of the corridor	
5. Topopah Option	--[g]	Located adjacent to corridor	
5a. Area 4 Alternate	--[g]	Variation along the Topopah Option	
5b. Mine Mountain Alternate	--[g]	Variation along the Topopah Option	
6. Mercury Highway Option	--[g]	Located adjacent to corridor	

a. Areas where natural floodwater movement might be altered and where erosion and sedimentation rates and locations could change. Sources:
   1. Federal Emergency Management Agency Flood Insurance Rate Maps for Lincoln and Nye Counties, Nevada.
   2. DIRS 154961-CRWMS M&O (1998, all).

b. About 91 percent of the Caliente-Chalk Mountain Corridor is not available on Federal Emergency Management Agency maps, due primarily to limited coverage in Lincoln County, the Nellis Air Force Range, and the Nevada Test Site.

c. To convert kilometers to miles, multiply by 0.62137.

d. Certain 100-year flood zones can be avoided by corridor variations. These are identified with a "Y" (yes) and a number representing the specific variation(s) that avoid the specific flood zone. The same flood zone might be crossed by both the corridor and variations at different locations. In such cases, the feature will be marked "Avoided" for the corridor route, but will appear again for the variations.

e. Projected from limited data. Specific area not covered by Federal Emergency Management Agency maps; values were extrapolated from the closest maps.

f. No information available on Federal Emergency Management Agency maps.

g. Limited information due to the Nellis Air Force Range or the Nevada Test Site.

Table 6-51. Hydrographic areas along Caliente-Chalk Mountain Corridor and its variations.

Description	Hydrographic areas	Designated Groundwater Basins	
		Number	Percent of corridor length
Caliente-Chalk Mountain Corridor	11	2	30
Variations[a]	10 to 12	2	30

a. Several of the variations would involve small changes in the hydrographic areas crossed or the crossing distances. However, all (Caliente Option, Crestline Option, White River Alternate, Garden Valley Alternate, Mercury Highway Option, Topopah Option, Mine Mountain Alternate, Orange Blossom Road Option, and Area 4 Alternate) would cross the same two Designated Groundwater Basins. Rounded to the nearest 10 percent, this would represent the same portion of the total corridor.

The withdrawal of about 14,000 cubic meters (11 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the corridor based on their perennial yields (Chapter 3, Section 3.2.2.1.3). However, the installation of 43 wells along the corridor would mean that many hydrographic areas would have multiple wells. As listed in Table 6-51, about 30 percent of the corridor length is over

Designated Groundwater Basins, which the Nevada State Engineer's office watches carefully for groundwater depletion. This does not mean that DOE could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. Because the DOE requests would be for a short-term construction action, the State Engineer would have even more discretion. Rather than spacing the wells evenly along the corridor, DOE could use well locations that would make maximum use of groundwater areas that are not Designated Groundwater Basins. Another option would be to lease temporary water rights from individuals along the corridor. Obtaining a water appropriation from the State Engineer for short-term construction use or using an approved allocation should ensure that groundwater resources did not receive adverse impacts.

As an alternative, DOE could transport water by truck to meet construction needs. The construction of a branch rail line in the Caliente-Chalk Mountain Corridor would require about 32,000 tanker-truck loads of water or about eight truckloads each day for each work camp area along the corridor. Again, water obtained from permitted sources, which would provide water in allocations determined by the Nevada State Engineer, would not affect groundwater resources.

Operations. Operations along a completed rail line would have little impact on groundwater resources. Possible changes in recharge, if any, would be the same as those at the completion of construction.

6.3.2.2.3.3 Caliente-Chalk Mountain Rail Biological Resources and Soils

Construction. The construction of a branch rail line in the Caliente-Chalk Mountain Corridor, including potential variations, would disturb about 12 square kilometers (3,000 acres) of land (Table 6-47). The analysis assumed that the types of land cover in disturbed areas outside the corridor would be the same as that within the corridor. Areas in eight of the land-cover types identified in Nevada (DIRS 104593-CRWMS M&O 1999, pp. C1 to C5) would be affected (Table 6-52). The greatest amounts of disturbance would occur in the salt desert scrub, sagebrush, and blackbrush land cover types, but would involve far less than 0.01 percent of the existing area in those types. The fraction disturbed for each cover type would be very small. The disturbance would have no discernable impact on the availability of habitat for plants or animals associated with any cover type. Although some alignment variations could lead to a small increase in the total amount of land disturbed, the portion of the corridor, including its variations, in each land-cover type would be similar to the unvaried corridor.

About 40 kilometers (25 miles) of the corridor length at its southern end, including potential variations, crosses desert tortoise habitat. Assuming that 0.06 square kilometer (15 acres) would be disturbed for each linear kilometer of railroad, construction activities would disturb as much as 2.4 square kilometers (590 acres) of desert tortoise habitat, some of which is classified as critical habitat. Such activities could kill individual desert tortoises; however, their abundance is low in this area (DIRS 101914-Rautenstrauch and O'Farrell 1998, pp. 407 to 411) so losses would be few. The presence of a branch rail line could interfere with movements of individual tortoises. Relocation of tortoises along the corridor prior to construction would minimize losses of individuals. If DOE selected this corridor, it would consult with the Fish and Wildlife Service (under Section 7 of the Endangered Species Act) in relation to this species and would implement all terms and conditions required by the Fish and Wildlife Service.

Although the southwestern willow flycatcher occurs near some portions of the Caliente-Chalk Mountain Corridor, there is no suitable habitat of dense riparian vegetation for this listed endangered species in the corridor (DIRS 152511-Brocoum 2000, pp. A-9 to A-13).

The Eccles, Crestline, and Caliente variations for this corridor cross a portion of the Meadow Valley Wash, which is habitat for an unnamed subspecies of the Meadow Valley Wash speckled dace and the Meadow Valley Wash desert sucker, both of which are sensitive species (see Chapter 3, Section 3.2.2.1.4). The construction of a branch rail line near Caliente could temporarily affect populations of these fish by increasing the sediment load in the wash during construction. Three special status plant

Table 6-52. Maximum area disturbed (square kilometers)[a] in each land-cover type for the Caliente-Chalk Mountain Corridor.[b,c]

Land cover type	Percent of corridor length	Area disturbed	Area in Nevada	Percent disturbed
Agriculture	0.5	0.05	5,200	0.01
Blackbrush	24.8	2.45	9,900	0.02
Creosote-bursage	0.0	0	15,000	0
Grassland	0.4	0.04	2,800	0.001
Greasewood	0.0	0	9,500	0
Hopsage	1.9	0.19	630	0.03
Juniper	0.0	0	1,400	0
Mojave mixed scrub	2.4	0.24	5,600	0.004
Pinyon-juniper	0.0	0	14,700	0
Playa	0.0	0	7,000	0
Sagebrush	30.1	3	67,000	0.004
Sagebrush/grassland	0.4	0.04	52,000	<0.001
Salt desert scrub	39.3	3.89	58,000	0.007
Urban		ND[d]	2,400	ND

a. To convert square kilometers to acres, multiply by 247.1.
b. Based on the proportion of the route in each land-cover type; percent disturbed was based on the variation with the greatest disturbance within a particular land-cover type. Percentages add to more than 100 because maximum values were used.
c. Source: DIRS 104593-CRWMS M&O (1999, Appendix D).
d. ND = not determined.

species are found along this corridor and its variations but could be avoided during land-clearing activities and would not be affected.

At least 40 populations of five sensitive plant species occur outside the 400-meter (0.25-mile)-wide corridor, but within 5 kilometers (3 miles) of the corridor. Several other populations of three other sensitive plant species occur within 5 kilometers of one or more of the corridor variations listed in Appendix J, Section J.3.1.2. DOE anticipates that these populations would be unaffected because land disturbance would not extend to these areas and changes in the aquatic or soil environment in these areas as a result of construction or the long-term presence of a railroad would be unlikely.

This rail corridor, including variations, would cross seven areas designated as game habitat and two areas designated as wild horse or wild horse and burro management areas. Construction activities would reduce habitat in these areas. Depending on the variation, several other designated game habitat areas could be within 5 kilometers (3 miles) of a rail line in the corridor. Game animals, burros, and horses near areas of active construction would be disturbed and their migration routes could be disrupted.

Two stream or riparian areas and possibly one spring (with the Caliente Option) are within the 0.4-kilometer (0.25-mile)-wide corridor, including its variations (Table 6-50). Although no formal delineations have been made, these areas may be jurisdictional wetlands or other waters of the United States. Construction could increase sedimentation in these areas. The corridor, including its potential variations, also crosses a number of ephemeral streams that may be classified as waters of the United States. DOE would work with the U.S. Army Corps of Engineers to minimize impacts to these areas and would obtain individual or regional permits if necessary. DOE anticipates some changes to local drainage along the branch rail line and would design the rail line to accommodate existing drainage patterns.

As many as 14 springs and riparian areas occur outside the 400-meter (0.25-mile)-wide corridor and its variations, but within 5 kilometers (3 miles) of the corridor under the variations. Eight known populations of three sensitive animal species are associated with these aquatic resources. DOE anticipates that these populations would be unaffected and these areas would not be disturbed during construction or by the long-term presence of a railroad.

Soils in and adjacent to the corridor would be disturbed on approximately 12 square kilometers (3,000 acres) of land. The impacts of disturbing 12 square kilometers of soil along the 345-kilometer (214-mile)-long corridor would be transitory and small. However, several soil characteristics could influence construction activities and the amount of area disturbed. Soils susceptible to water or wind erosion occur along much of the corridor and its variations as do soils exhibiting relatively high shrink-swell characteristics (see Chapter 3, Section 3.2.2.1.4). Disturbance of erodible soils could lead to increased silt loads in water courses or increased soil transport by wind. Erosion control during construction and revegetation, or other means of soil stabilization after construction, would minimize these concerns. The presence of soils with poor (that is high) shrink-swell characteristics could influence the amount of area disturbed by construction if soils from outside areas had to be brought in for replacement or mixing with native soil.

As stated in Chapter 3, Section 3.2.2.1.4, variations identified for the Caliente-Chalk Mountain Corridor could avoid some biological resources, as listed in Table 6-53.

Table 6-53. Biological resources avoided by Caliente-Chalk Mountain Corridor variations.[a,b,c]

	Occurrence of resource			
	For unvaried segment of corridor		Occurrence avoided by variation	
Alignment variation resource	In corridor[b]	Within 5 km[c]	In corridor	Within 5 km
Caliente Variation				
Sensitive species–Needle Mountain Milkvetch	0	3	0	1
Springs or groups of springs	1	14	0	1
Crestline Variation				
Sensitive species–Needle Mountain Milkvetch	0	3	0	3
Springs or groups of springs	1	14	0	4
Mercury Highway, Topopah, Mine Mountain, and Area 4 Variations				
Sensitive species				
Beatley's scorpionweed	0	17	0	17
Funeral Mountain milkvetch	0	1	0	1
Largeflower suncup	1	18	1	17
Ripley's springparsley	1	1	1	0
Mine Mountain Variation only				
Sensitive species				
Largeflower suncup	0	1	0	1
Oasis Valley springsnail	0	1	0	1
Springs or groups of springs	1	14	0	1

a. Variations listed are those that would result in the avoidance of biological resources along the corridor.
b. In the corridor [or springs within 400 meters (0.25 mile)], but avoided by the corridor variation.
c. Within 5 kilometers (3 miles) of the corridor, but more than 5 kilometers from the corridor variation.

6.3.2.2.3.4 Caliente-Chalk Mountain Rail Cultural Resources

Construction. The potential for cultural resource impacts in the Caliente-Chalk Mountain Corridor would be identical to that for the Caliente Corridor, as discussed in Section 6.3.2.2.1.4, until the Caliente-Chalk Mountain Corridor diverges at the northern boundary of the Nellis Air Force Range. From that point south the corridor passes through the Range and the Nevada Test Site to the repository site.

Archaeological site file searches have identified the presence of 100 recorded sites in the Caliente-Chalk Mountain Corridor (see Chapter 3, Section 3.2.2.1.5), including the variations (Appendix J, Section J.3.1.2). Of these, 34 are potentially eligible for inclusion in the *National Register of Historic Places.* Precise impacts to any of these resources cannot be specified until the rail alignment has been identified and its relationship to the known archaeological sites evaluated. At some point on the Nevada

Test Site, the Caliente-Chalk Mountain Corridor would intersect the 1849 Jayhawker's Emigrant Trail, but because physical expressions of the trail are unlikely, no direct impacts would occur. Although there are no known Native American resources in the corridor, there have been no field ethnographic studies. If DOE selected this corridor, this assessment of the potential for such impacts would have to wait until the completion of field studies involving Native Americans.

Operations. As stated in Section 6.3.2.1, additional impacts to these resources during the operation of the branch rail line would be unlikely.

6.3.2.2.3.5 Caliente-Chalk Mountain Rail Occupational and Public Health and Safety

Construction. Industrial safety impacts on workers from the construction and use of the Caliente-Chalk Mountain branch rail line would be small (Table 6-54). The analysis evaluated the potential for impacts in terms of total reportable cases of injury, lost workday cases, and fatalities to workers and the public from construction and operation activities. The analysis also evaluated traffic fatality impacts that would occur in moving equipment and materials for construction, worker commutes to and from construction sites, and transport of water to construction sites if wells were not available. Table 6-55 lists these results.

Table 6-54. Impacts to workers from industrial hazards during rail construction and operations for the Caliente-Chalk Mountain Corridor.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	79	95
Lost workday cases	39	52
Fatalities	0.11	0.26
Noninvolved workers		
Total recordable cases	4.8	5.4
Lost workday cases	1.8	2.0
Fatalities	0.005	0.006
Totals[d]		
Total recordable cases	84	100
Lost workday cases	41	54
Fatalities	0.12	0.27

a. Totals for 43 months for construction.
b. Totals for 24 years for operations.
c. Total recordable cases includes injury and illness.
d. Totals might differ from sums due to rounding.

Operations. Incident-free radiological impacts would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste in the Caliente-Chalk Mountain rail corridor.

Table 6-56 lists the incident-free impacts, which include transportation along the corridor and along railways in Nevada leading to a Caliente-Chalk Mountain branch line. The table includes the impacts of 1,079 legal-weight truck shipments from commercial sites that do not have the capability to load rail casks while operational.

6.3.2.2.3.6 Caliente-Chalk Mountain Rail Socioeconomics

The following paragraphs discuss potential socioeconomic impacts associated with the construction and operation of a branch rail line in the Caliente-Chalk Mountain Corridor.

Table 6-55. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Caliente-Chalk Mountain Corridor.

Activity	Kilometers[a]	Traffic fatalities	Emissions fatalities
Construction[b]			
Material delivery vehicles	14,000,000	0.2	0.03
Commuting workers	61,000,000	0.6	0.08
Subtotals	*75,000,000*	*0.8*	*0.11*
Operations[c]			
Commuting workers	68,000,000	0.7	0.09
Totals	***140,000,000***	***1.5***	***0.2***

a. To convert kilometers to miles, multiply by 0.62137.
b. Totals for 43 months for construction.
c. Totals for 24 years for operations.

Table 6-56. Health impacts from incident-free Nevada transportation for the Caliente-Chalk Mountain implementing alternative.[a]

Category	Legal-weight truck shipments	Rail shipments	Totals[b]
Involved workers			
Collective dose (person-rem)	38	700	740
Estimated latent cancer fatalities	0.02	0.28	0.3
Public			
Collective dose (person-rem)	7	12	18
Estimated latent cancer fatalities	0.003	0.01	0.01
Estimated vehicle emission-related fatalities	0.002	0.0055	0.0071

a. Impacts are totals for 24 years.
b. Totals might differ from sums of values due to rounding.

Construction. The length of the Caliente-Chalk Mountain Corridor, 345 kilometers (214 miles), would determine the number of workers required. The construction of a branch rail line in this corridor would require workers laboring for approximately 2 million hours or about 1,000 worker-years over a 43-month construction period. The route would require four construction camps to house workers temporarily (DIRS 154822-CRWMS M&O 1998, all).

Employment

Estimated employment in the region of influence attributable to the construction of a Caliente-Chalk Mountain branch rail line, would peak in 2007 at about 647 jobs. Clark County would supply approximately 569 of the workers and Nye County would supply about 22. These additional workers would represent an increase of less than 1 percent of the Clark and Nye County employment baselines. About 56 individuals would work in Lincoln County, adding about 2.3 percent to employment in the county. DOE anticipates changes in Lincoln County's employment would be primarily the result of indirect employment caused by the presence of transient construction workers. Employment of Caliente-Chalk Mountain Corridor construction workers and some indirect support workers would end in 2009. As a result, the projected total growth (2009 to 2010) of 15,240 jobs in the region of influence would be reduced by 612. The expected addition of 14,886 jobs in Clark County would be reduced by 594, and the expected growth of 330 jobs in Nye County would be reduced by 17. The expected growth of 24 jobs in Lincoln County would be reduced by 1. DOE anticipates that project-related workers not moving to Caliente-Chalk Mountain Corridor operational jobs would be absorbed in other work in the State. These changes in employment would represent less than 1 percent of the applicable baselines.

Population

Population increases in the region of influence attributable to the construction of a Caliente-Chalk Mountain rail line would peak in 2009 at 589 persons. Clark County would gain about 527 residents, Nye County about 24, and Lincoln County about 38. The increase in population would be less than 1 percent of the baselines for Clark, Nye, and Lincoln Counties. Because the change in the population, relative to the population baselines, would be small and transient in Clark, Nye, and Lincoln Counties, impacts to housing or schools would be unlikely.

Economic Measures

The expected peak year changes in economic measures in the region of influence attributable to a branch rail line in the Caliente-Chalk Mountain Corridor would be increases of $18.6 million in real disposable income in 2009; $30.9 million in Gross Regional Product in 2007; and $2.1 million in State and local expenditures in the last year of construction, 2009. More than 93 percent of the real disposable income and Gross Regional Product would accrue to Clark County, which would experience about 78 percent of the additional spending by State and local governments. Lincoln County would gain slightly less than 4.6 percent of the change in real disposable income, 3.7 percent of the change in Gross Regional Product, and 16 percent of the expenditures by State and local governments. The increases in each economic measure

would be less than 1 percent of the baseline in each affected county, except the increase of expenditures by State and local governments in Lincoln County would be 1.1 percent. (Dollar values reported in this section are in 2001 dollars unless otherwise stated.)

Transition and Operations Period. A period of slightly slower growth in employment in the region of influence would occur from 2010 to 2012. Following this period, employment to operate a Caliente-Chalk Mountain branch rail line would stimulate growth in the region. Growth in employment in the region of influence during the transitional period would average 19 fewer jobs than would occur without a Caliente rail line. Clark County would absorb the entire slower rate of growth, with an average of 82 fewer jobs. The Clark County employment baseline would average about 1 million during this period. Nye County would gain an average of 5 jobs and Lincoln County would gain 57 jobs during this period. The job gain in Lincoln County would represent a 2.2-percent average increase over the employment baseline in the 3-year period. The employment gain in Nye County would be less than 1 percent. A Caliente-Chalk Mountain rail line would contribute to the growth in residential population throughout the transition period and into the employment base after 2012.

Employment and Population

Estimated direct employment to operate a Caliente-Chalk Mountain rail line would be 47 jobs. Increased total employment in the region of influence would average about 78 jobs over the 24-year operations period (2010 to 2033). The majority, 57, would work in Lincoln County. The increases in Lincoln County employment attributable to a Caliente-Chalk Mountain branch rail line would be 2.1 percent of the baseline. On average, 14 jobs would be created in Clark County and 6 in Nye County. The change in the population in the region from the operation of a Caliente-Chalk Mountain branch line would average about 290 persons. DOE anticipates that 99 of these individuals would settle in Lincoln County, representing a 2.1-percent increase of the population baseline for the County. An additional 171 would live in metropolitan Clark County and represent less than 1 percent of the County's population baseline. The remaining individuals would live in Nye County and would affect the community by less than 1 percent. There would be no impacts to the school system or the housing market in Clark or Nye Counties. The increase in population in Lincoln County would add an average of about 22 students a year to the rolls of the school system. There would be no impact to housing in Lincoln County given the high housing vacancy rate in the County (see Chapter 3, Section 3.1.7.4).

Economic Measures

The estimated average, real disposable income increase attributable to the operation of a Caliente-Chalk Mountain branch rail line in the three-county region of influence would be $4.7 million per year. Contributions to real disposable personal income would range from $3.2 million in the early years of operation to $5.6 million in the last year. The annual increase in Gross Regional Product would average $4.6 million. On average, changes in real disposable income would exceed changes in Gross Regional Product. The increases in annual State and local government expenditures would average $1.6 million. The average impacts to real disposable income, Gross Regional Product, and State and local government expenditures from operating a Caliente-Chalk Mountain branch rail line would be less than 1 percent of the baselines for Clark and Nye Counties.

In Lincoln County, the changes in real disposable income and Gross Regional Product of operating a Caliente-Chalk Mountain branch rail line would range from about 1.7 percent for real disposable income to 2.6 percent for Gross Regional Product. State and local government spending would be higher by about 2.5 percent of the baseline. Workers associated with a Caliente-Chalk Mountain branch rail line would purchase many goods and services in the Lincoln County community. These dollars would continue to circulate largely within the area creating a positive economic impact. These impacts would not exceed historic short-term changes in the various socioeconomic measures.

DOE performed a detailed analysis was for the Caliente-Chalk Mountain Corridor. The results of this analysis, driven by the length of the Corridor, is representative of the potential variations (options and alternates) listed in Appendix J, Section J.3.1.2. The lengths of the variations are similar to those listed in Table 6-48.

In addition, DOE analyzed a sensitivity case that assumed all Lincoln County socioeconomic impacts would occur only in the City of Caliente. Under this assumption, City population would rise by 3 percent during construction and by 6.9 percent during operations. Employment would rise by about 5 percent during construction and about 7.2 percent during operations. If DOE selected this rail corridor, it would initiate additional engineering and environmental studies (including socioeconomic analyses); consult with Federal, State of Nevada, Native American, and local governments; and perform additional National Environmental Policy Act reviews as a basis for constructing and operating a Caliente-Chalk Mountain Corridor.

6.3.2.2.3.7 Caliente-Chalk Mountain Rail Noise and Vibration

Over most of its length, the Caliente-Chalk Mountain Corridor passes through undeveloped land managed by the Bureau of Land Management where human inhabitants are mostly isolated ranchers and persons involved with outdoor recreation. Almost half of the corridor's length is on the Nellis Air Force Range and Nevada Test Site, where there is little potential for noise impacts. The Caliente and Caliente-Chalk Mountain Corridors are the same in most of Lincoln County and in the northeastern part of Nye County. The Towns of Caliente and Panaca are along the eastern end of the corridor. This corridor includes the Caliente Option, Eccles Option, and Crestline Option as starting points; these are fairly remote from any rural communities.

The five variations on restricted government land (see Appendix J, Section J.3.1.2), the White River Alternate, and the Garden Valley Alternate would not affect rural communities. The variations outside restricted government land pass through areas that are farmed. Hence, some rural residences in this area could fall within the region of influence for noise.

None of the communities along the Caliente-Chalk Mountain Corridor and its nine variations (see Appendix J, Section J.3.1.2), with the exception of Caliente, would be close enough to the rail line for noise impacts to approach the noise guidelines of 50 dBA for evenings and 60 dBA during the day (Table 6-57). The Caliente Option for connecting to the Union Pacific Railroad mainline would follow an old railroad bed through the center of the Town of Caliente. Noise levels in Caliente would not differ much from existing background noise levels associated with normal rail traffic through the community. Noise levels associated with waste shipments would occur at most three times a day and probably not in a given hour. Where a branch rail line passed through Caliente, train speed would be reduced for safety and noise levels would be minimized. Traffic could be delayed at one traffic crossing in the Town of Caliente. Adverse community response to the added rail noise would be unlikely because of the long-term presence of railroad traffic in Caliente, the short trains associated with the transport of waste shipments, and the low frequency of rail shipments to and from the site.

The estimated population residing within 2 kilometers (1.3 miles) of the Caliente-Chalk Mountain Corridor in 2035 would be about 28 persons.

Vibration. Except for the historic railroad station in Caliente, which is near the existing Union Pacific Railroad mainline, the branch rail line in the Caliente-Chalk Mountain Corridor and associated variations would be sufficiently distant from historic structures, cultural ruins, and buildings to preclude building damage as a result of ground vibration. Vibration levels at reduced train speeds would be unlikely to damage the Caliente Railroad station. Moreover, the vibrations added by the relatively few trains carrying waste to Yucca Mountain at slow speeds would not add appreciably to the total vibration to

Table 6-57. Estimated propagation of noise from the operation of a waste transport train with two locomotives in communities near the Caliente-Chalk Mountain Corridor.

Corridor[a]/community	Distance (kilometers)[b]	Noise (dBA)[c]
Caliente Option		
Caliente	0	>90 at 15 meters[d]
Panaca	6[e]	26.0
Crestline Option		
Panaca	4.5[e]	26.3
Eccles Option		
Caliente	6.5[e]	<26[f]
Rachel	>20[e]	<26

a. The White River, Garden Valley, Mercury Highway, Topopah, Mine Mountain, Area 4, and Orange Blossom Road variations occur on Nellis Air Force Range or Nevada Test Site lands, too far from any community to cause noise impacts.
b. To convert kilometers to miles, multiply by 0.62137.
c. Estimated values do no include noise loss due to interactions with the ground that could account for decreases in estimated noise levels of from 10 to 20 dBA at 100 meters (330 feet) from the tracks.
d. 15 meters = 49 feet.
e. Noise estimates at distances greater than 2 kilometers (1.2 miles) have large uncertainty.
f. At these distances, the A-weighted sound pressure level is dominated by lower frequencies (less than 63 hertz) and would not be distinguishable from normal background levels of noise.

which the station is exposed from commercial trains that pass through Caliente. The small number of trips (three per day) and the small train size would result in low levels of rail-induced ground vibration.

6.3.2.2.3.8 Caliente-Chalk Mountain Rail Utilities, Energy, and Materials

Table 6-58 lists the use of fossil fuels and other materials in the construction of a Caliente-Chalk Mountain branch rail line.

Table 6-58. Construction utilities, energy, and materials for a Caliente-Chalk Mountain branch rail line.

Length (kilometers)[a]	Diesel fuel use (million liters)[b]	Gasoline use (thousand liters)	Steel (thousand metric tons)[c]	Concrete (thousand metric tons)[c]
340 - 370	32 - 36	610 - 680	47 - 52	280 - 310

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.

6.3.2.2.4 *Jean Corridor Implementing Alternative*

The Jean Corridor originates at the existing Union Pacific mainline railroad near Jean, Nevada. It travels northwest, passing near the Towns of Pahrump and Amargosa Valley before reaching the Yucca Mountain site. The Jean Corridor is about 181 kilometers (114 miles) long from its link at the Union Pacific line to the site. Variations of the route range from 181 to 204 kilometers (112 to 127 miles). Figure 6-18 shows this corridor along with possible variations identified by engineering studies (DIRS 154822-CRWMS M&O 1998 p. 1, Item 6; see Appendix J, Section J.3.1.2). The corridor variations provide flexibility in addressing engineering, land-use, or environmental resource issues that could arise in a future survey along the corridor. This section addresses impacts that would occur along the corridor shown in Figure 6-18. With the exception of differences identified in Appendix J, Section J.3.1.2, the impacts would be generally the same among the possible corridor variations.

The construction of a branch rail line in the corridor would require approximately 43 months. Construction would take place simultaneously at a number of locations. An estimated two construction camps would be established at roughly equal distances along the corridor. These camps would provide temporary living accommodations for construction workers and construction support facilities. A train would take about 4 hours to travel from the junction with the Union Pacific mainline to a Yucca Mountain

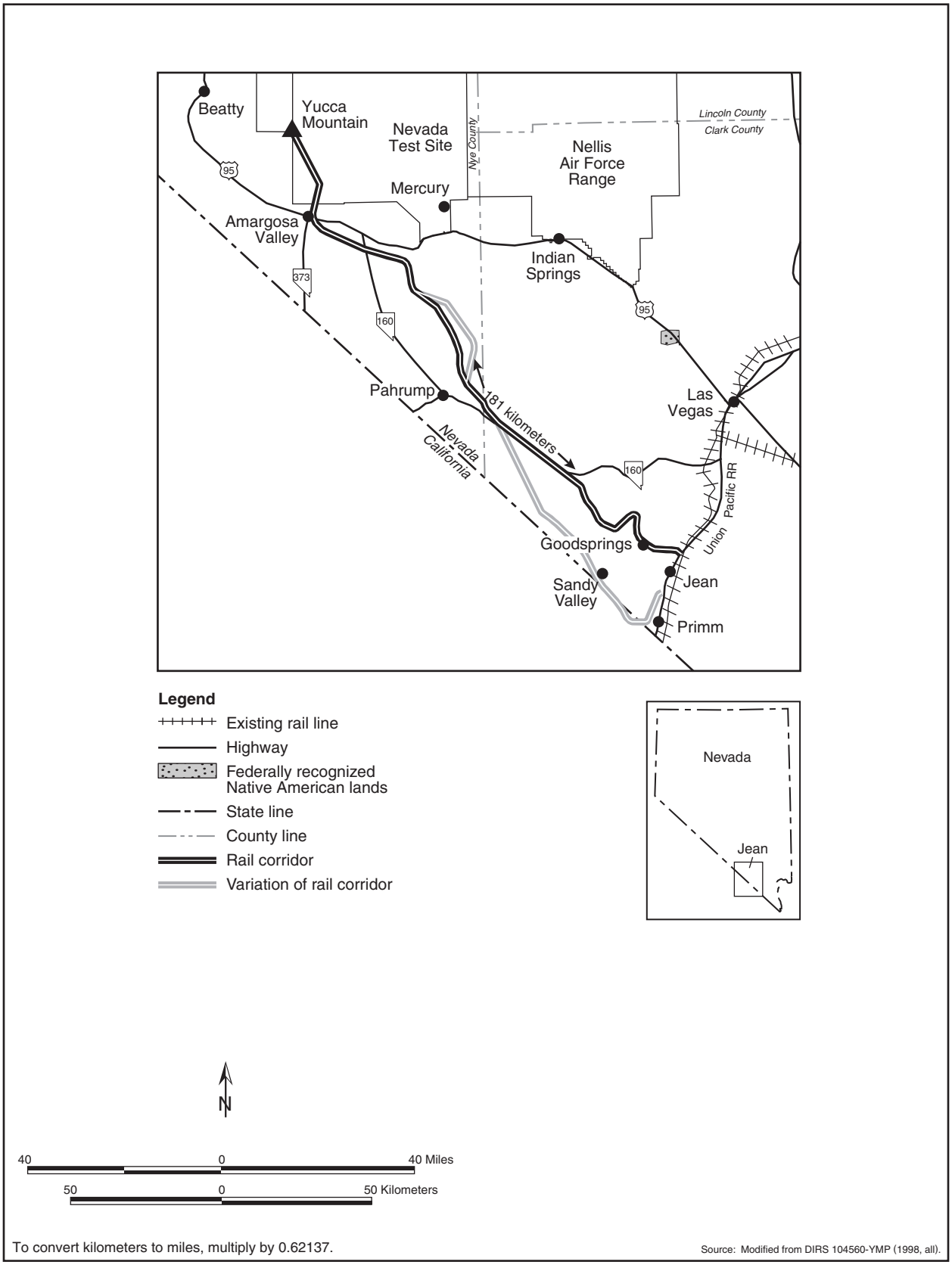


Figure 6-18. Jean Corridor.

Repository on a Jean branch rail line (DIRS 101214-CRWMS M&O 1996, Volume 1, Section 4, Branch Rail Operations Plan). The estimated life-cycle cost to construct and operate a branch rail line in the Jean Corridor would be $462 million in 2001 dollars.

The following sections address impacts that would occur to land use; biological resources and soils; cultural resources; hydrology, including surface water and groundwater; occupational and public health and safety; socioeconomics; noise and vibration; aesthetics; and utilities, energy, and materials. Impacts that would occur to air quality and waste management would be the same as those discussed in Section 6.3.2.1 and are, therefore, not repeated here. Section 6.3.4 discusses the potential for transportation activities to cause environmental justice impacts in Nevada.

6.3.2.2.4.1 Jean Rail Land Use and Ownership

Table 6-59 summarizes the amount of land required for the Jean Corridor, its ownership, and the estimated amount of land that would be disturbed, as well as ranges for the variations. Table 6-60 summarizes the amount of land required for the Jean Corridor variations and its ownership.

Table 6-59. Land use in the Jean Corridor.[a]

Factor	Corridor (percent)	Range due to variations
Corridor length (kilometers)[b]	181	181 - 204
Land area in 400-meter[c]*-wide corridor (square kilometers)*[d]	72 (100)	72 - 82
Land ownership in 400-meter-wide corridor (square kilometers)		
Bureau of Land Management	60 (83)	60 - 69
Air Force	None	None
DOE	8.5 (12)	8.5 - 8.5
Private	3.5 (5)	0.1 - 3.5
Other	None	None
Land area in 60-meter[e] *right-of-way (square kilometers)*	10.9	10.8 - 12.2
Disturbed land (square kilometers)		
Inside 60-meter right-of-way	6.6	6.6 - 7.4
Outside 60-meter right-of-way	2.6	2.6 - 2.9

a. Source: DIRS 155549-Skorska (2001, all).
b. To convert kilometers to miles, multiply by 0.62137.
c. 400 meters = about 0.25 mile.
d. To convert square kilometers to acres, multiply by 247.1.
e. 60 meters = 200 feet.

Table 6-60. Variations in the Jean Corridor.[a]

Variation	Length (kilometers)[b]	Area in variation (square kilometers)[c]	Land ownership [square kilometers (percent)]	
			Bureau of Land Management	Private
Wilson Pass Option	73.5	29.4	29.4 (99.98)	0.01 (0.02)
Pahrump Valley Alternate	32.1	12.8	12.7 (99.2)	0.1 (0.8)
Stateline Pass Option	91.9	36.8	36.79 (99.97)	0.01 (0.03)

a. Source: DIRS 155549-Skorska (2001, all).
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert square kilometers to acres, multiply by 247.1.

Construction. The Jean Corridor (Wilson Pass Option) crosses eight Bureau of Land Management grazing allotments (Mount Stirling, Spring Mountain, Stump Springs, Table Mountain, Wheeler Wash, and three unnamed and unallotted areas); two wild horse and burro herd management areas (both in Pahrump Valley); the Old Spanish Trail/Mormon Road special recreation management area; and four areas designated as available for sale or transfer. It also crosses several telephone, pipeline, highway, and power line rights-of-way. The corridor is within 1.6 kilometers (1 mile) of the Toiyabe National Forest and three mines (Bluejay, Snowstorm, and Pilgram). The Wilson Pass Option also passes through Bureau

of Land Management Class II lands in the vicinity of Wilson Pass in the Spring Mountains, potentially affecting the recreational use of this area.

The Stateline Pass Option origination location along an existing Union Pacific rail line conflicts directly with lands set aside for the proposed Ivanpah Valley Airport under the Ivanpah Valley Airport Public Lands Transfer Act (Public Law 106-362, 114 Stat. 1404). The Stateline Pass Option crosses the California-Nevada boundary line along Bureau of Land Management lands and passes near the Stateline Wilderness Area established by the California Desert Conservation Act. Construction activities could affect recreational use of the Stateline Wilderness Area. Impacts would be similar to the construction impacts discussed in Section 6.3.2.1. Corridor variations are listed in Appendix J, Section J.3.1.2. Impacts common to the rail implementing alternates are discussed in Section 6.3.2.1. The following paragraphs discuss impacts unique to this corridor.

The transfer of land from Bureau of Land Management for the Ivanpah Valley Airport would require DOE to realign the Stateline Pass Option for constructing a branch rail line.

Construction activities could affect the Old Spanish Trail/Mormon Road special recreation management area. Ease of access from one portion of the management area to the other would be reduced. These impacts could be mitigated by providing access to connect the parcels separated by the railroad right-of-way.

In the vicinity of Pahrump, Nevada, a branch rail line in the Jean Corridor would pass through approximately 9 kilometers (5.5 miles) of private property. As discussed in Section 6.3.2.1, DOE would have to make arrangements with owners to use this land. As indicated in Appendix J, Section J.3.1.2, the North Pahrump Alternate includes no private property. The North Pahrump Alternate would abut a Bureau of Land Management utility corridor and a section of the Toiyabe National Forest and could affect access to these recreational areas.

During the construction and operation and monitoring phases of the Proposed Action, there would be a potential for encroachment of the Jean Corridor by private interests. If encroachment occurred, conflicts could result as impediments to the full use of the land. Areas most likely for use by private interests are those already privately owned in the vicinity of Pahrump and those that are currently designated for sale or transfer by the Bureau of Land Management.

If DOE decided to build and operate a branch rail line in the Jean corridor, it would consult with the Bureau of Land Management and other affected agencies and with Native American tribal governments to help ensure that it avoided or mitigated potential land-use conflicts associated with alignment of a right-of-way.

Although there are no known community development plans that would conflict with the rail line, the presence of a rail line could influence future development and land use along the railroad in the communities of Amargosa Valley, Goodsprings, Jean, Johnnie, and Pahrump (that is, zoning and land use might differ depending on the presence or absence of a railroad). Construction of a branch rail line within the Jean corridor would require conversion of land within wild horse or wild horse and burro management areas; however, because the railroad would be unlikely to interfere with animal movements, the functionality of these areas would not be affected.

Operations. As with the other corridors, DOE expects the operation of a branch rail line in the corridor to cause fewer impacts than construction. Impacts due to rail operations would be similar to those described in Section 6.3.2.1.

6.3.2.2.4.2 Jean Rail Hydrology

Surface Water

Chapter 3, Section 3.2.2.1.3, notes that there are no surface-water resources along the Jean Corridor, including its variations.

Table 6-61 lists flood zones identified along the Jean Corridor and its variations. The Federal Emergency Management Agency maps from which DOE derived the flood zone information provided coverage for 90 percent of the corridor length. This corridor would cross seven 100-year flood zones or flood-zone groups before entering the Nevada Test Site. One of the two variations would increase the number of flood zones crossed by 1; the other segment would have no change. As indicated in Section 6.3.2.1, impacts associated with altering drainage patterns or changing erosion and sedimentation rates or locations would be minor and localized.

Table 6-61. 100-year flood zones crossed by the Jean Corridor and its variations.[a,b]

Corridor portion	Crossing distance (kilometers)[c]	Flood zone feature(s)	Avoided by variation[d] (Yes or No)
Jean to Yucca Mountain	0.6	Three tributaries leading to Roach Lake (intermittent)	Y-2
	0.7	Lovell Wash with drainage (intermittent)	Y-2
	0.4	Two unnamed washes northwest of Lovell Wash	N
	4.1	Peak Springs Alluvial Fan (dry)	N
	1.9	Wheeler Wash (dry)	N
	0.3	Wash drainage leading to Alkali Flats (dry)	N
	0.1	Rock Valley Wash (intermittent)	N
Variations			
1. Pahrump Valley Alternate	None	Located northeast of corridor.	
2. Stateline Pass Option	0.4	Crosses two tributaries to Roach Lake (dry).	
	0.8	Crosses Potasi Wash, an unnamed wash, and Lovell Wash drainage.	
	1.1	Crosses four unnamed washes and Peak Springs Fan (intermittent).	

a. Areas where natural floodwater movement could be altered and where erosion and sedimentation rates and locations could change. Sources:
   1. Federal Emergency Management Agency Flood Insurance Rate Maps for Clark and Nye Counties, Nevada.
   2. DIRS 154961-CRWMS M&O (1998, all).

b. About 10 percent of the Jean Corridor is not available on Federal Emergency Management Agency maps because a portion of the route is on the Nevada Test Site.

c. To convert kilometers to miles, multiply by 0.62137.

d. Certain 100-year flood zones can be avoided by alternative corridor segments. These are identified with a "Y" (yes) and a number representing the variation(s) that avoid the specific flood zone. The same flood zone might be crossed by both the corridor and variations at different locations. In such cases, the feature will be marked "Avoided" for the corridor route, but will appear again for the variation.

Groundwater

Construction. The water used during construction would come largely from groundwater resources. The annual demands would be a fraction of the perennial yields of most producing aquifers (Chapter 3, Section 3.2.2.1.3, discusses estimated perennial yields for the hydrographic areas over which the Jean Corridor passes).

The estimated amount of water needed for construction of a rail line in the corridor for soil compaction, dust control, and workforce use would be about 500,000 cubic meters (410 acre-feet) (DIRS 104914-DOE 1998, all). For planning purposes, DOE assumed that this water would come from 23 wells installed along the corridor. The average amount of water withdrawn from each well would be approximately 22,000 cubic meters (18 acre-feet). Most (89 percent) of the water would be used for compaction of fill material. The estimate of fill quantities needed for construction would vary if DOE used a variation. Use of the Pahrump Valley Alternate or Stateline Pass Option would involve an increase in fill material (over that required for the corridor) and would increase the total water demand by 12 or 27 percent, respectively.

Chapter 3, Section 3.2.2.1.3, discusses the hydrographic areas over which the corridor would pass, their perennial yields, and whether the State of Nevada considers each a Designated Groundwater Basin. If the hydrographic area is a Designated Groundwater Basin, permitted groundwater rights approach or exceed the estimated perennial yield, depleting the basin and water resources or requiring additional administration. Table 6-62 summarizes the status of the hydrographic areas associated with the Jean Corridor and the approximate portion of the corridor that passes over Designated Groundwater Basins. The use of variations would change the number of hydrographic areas crossed, but would have no effect on the portion of the corridor crossing Designated Groundwater Basins.

Table 6-62. Hydrographic areas along the Jean Corridor and its variations.

Description	Hydrographic areas	Designated Groundwater Basins	
		Number	Percent of corridor length
Jean Corridor	7	5	90
With Stateline Pass Option	6	4	90
With Pahrump Valley Alternate	7	5	90

The withdrawal of 22,000 cubic meters (18 acre-feet) a year from a well would have little impact on the hydrographic areas associated with the corridor based on their perennial yields (Chapter 3, Section 3.2.2.1.3). However, the installation of 23 wells along the corridor would mean that several of the hydrographic areas would have multiple wells. As indicated in Table 6-62, about 90 percent of the corridor length is over Designated Groundwater Basins, which the Nevada State Engineer's office watches carefully for groundwater depletion. This does not mean that DOE could not obtain water appropriations in these areas; the State Engineer would have the authority to approve such appropriations. Because the DOE requests would be for a short-term construction action, the State Engineer would have even more discretion. Rather than spacing the wells evenly along the corridor, DOE could use locations that would make maximum use of groundwater areas that are not Designated Groundwater basins. With such a large portion of the corridor over these basins, however, this would mean trucking water for long distances. Another option would be to lease temporary water rights from individuals along the corridor. Obtaining a water appropriation from the State Engineer for short-term construction use or using an approved allocation should ensure that groundwater resources are not adversely affected.

As an alternative, DOE could transport water by truck to meet construction needs. The construction of a branch rail line in the Jean corridor would require about 27,000 tanker-truck loads of water or about 14 truckloads each day for each work camp area along the corridor. Again, water obtained from permitted sources, which would provide water within allocations determined by the Nevada State Engineer, would not affect groundwater resources.

Operations. Operations along a completed rail line would have little impact on groundwater resources. Possible changes in recharge, if any, would be the same as those at the completion of construction.

6.3.2.2.4.3 Jean Rail Biological Resources and Soils

Construction. The construction of a branch rail line in the Jean Corridor would disturb approximately 9.3 square kilometers (2,300 acres) of land (Table 6-59). The analysis assumed that the types of land cover in disturbed areas outside the corridor would be the same as that within the corridor. Table 6-63 compares the approximate area of disturbance in each land-cover type along all variations of the Jean Corridor to the area in each land-cover type in Nevada. In addition, the table lists the percentage of the area that would be disturbed. The fraction disturbed for each cover type would be very small. The disturbance would not have a discernible impact on any land-cover type. Although some alignment variations could lead to a small increase in the total amount of land disturbed, the portion of the corridor, including its variations, in each land-cover type would be similar to that in the unvaried corridor.

Table 6-63. Maximum area disturbed (square kilometers)[a] in each land-cover type for the Jean Corridor.[b,c]

	Wilson Pass Option		Stateline Pass Option			
Land-cover type	Percent of corridor length	Land area	Percent of corridor length	Land area	Area in Nevada	Percent disturbed
Agriculture	0	0	0	0	5,200	0
Blackbrush	18.4	1.69	0.1	0.01	9,900	0.017
Creosote-bursage	58.6	5.39	80.8	8.32	15,000	0.055
Grassland	0	0	0	0	2,800	0
Greasewood	0	0	0	0	9,500	0
Hopsage	0	0	0	0	630	0
Juniper	0	0	0	0	1,400	0
Mojave mixed scrub	21.1	1.94	14.6	1.5	5,600	0.035
Pinyon-juniper	0	0	0	0	15,000	0
Playa	0	0	0	0	7,000	0
Sagebrush	0	0	0	0	67,000	0
Sagebrush/grassland	0	0	0	0	52,000	0
Salt desert scrub	2	0.18	1.8	0.19	58,000	<0.001
Urban	ND[d]	ND	ND	ND	2,400	ND
Total[e]	100	9.2	97.3[f]	10	250,000	N/A[g]

a. To convert square kilometers to acres, multiply by 247.1.
b. Based on the proportion of the route in each land-cover type; percent disturbed was based on the variation with the greatest disturbance within a particular land-cover type. Percentages add to more than 100 because maximum values were used.
c. Source: DIRS 104593-CRWMS M&O (1999, Appendix D).
d. ND = not determined.
e. Totals might differ from sums of values due to rounding.
f. About 2.7 percent of land would be in California for the proposed Jean corridor with the Stateline Pass Option.
g. N/A = not applicable.

The Jean Corridor, including its variations passes through desert tortoise habitat along its entire length, so construction activities would disturb approximately 9.3 square kilometers (2,300 acres) of desert tortoise habitat, some of which is designated as critical habitat. Construction activities could kill individual desert tortoises, and the presence of a rail line could disrupt movements of individuals. The abundance of tortoises is low along much of this corridor; however, some areas in the Ivanpah, Goodsprings, Mesquite, and Pahrump Valleys have higher abundance (DIRS 101521-BLM 1992, Map 3-13; DIRS 101914-Rautenstrauch and O'Farrell 1998, pp. 407 to 411). DOE anticipates that losses would be few and would be unlikely to affect the regional population of the desert tortoise. Relocation of tortoises along the corridor prior to construction would minimize losses of individuals. DOE would consult with the Fish and Wildlife Service (under Section 7 of the Endangered Species Act) in relation to this species if it selected this corridor and would implement all terms and conditions required by the Fish and Wildlife Service.

Two populations of Pinto beardtongue (a Bureau of Land Management sensitive species) occur in the corridor and could be affected directly or indirectly by land-clearing activities. The locations of these populations would be identified though surveys prior to disturbance and would be avoided to the extent possible. No populations of sensitive species occur in the Stateline Pass Option.

There are 33 populations of seven sensitive plant species outside the 400-meter (0.25-mile)-wide corridor, but within 5 kilometers (3 miles) of the corridor. Thirteen populations of five sensitive plant species are outside the corridor but within 5 kilometers of the Stateline Pass Option. These populations would not be affected because land disturbance would not extend to these areas. Changes in the aquatic or soil environment in these areas as a result of construction would be unlikely.

Ten designated game habitat areas for bighorn sheep, mule deer, or quail occur within the corridor and 16 areas occur within 5 kilometers (3 miles) of the corridor. The Stateline Pass Option avoids five of the designated game habitat areas in the corridor.

The Wilson Pass Option crosses three Herd Management Areas for wild horses and burros (DIRS 104593-CRWMS M&O 1999, p. 3-29). The Stateline Pass Option would avoid two of these areas. Construction activities in these areas would result in the loss of a small amount of habitat and probably would disturb animals or their movements for the duration of the activities.

No springs, perennial streams, or riparian areas occur in the Jean Corridor. Eleven springs or groups of springs are outside the corridor, but within 5 kilometers (3 miles) of the corridor. Impacts to biological resources associated with these areas are not anticipated. The corridor crosses a number of ephemeral streams that may be classified as waters of the United States, although formal delineations have not been made (DIRS 104593-CRWMS M&O 1999, p. 3-29). DOE would work with the U.S. Army Corps of Engineers to minimize impacts to these areas and would obtain individual or regional permits if necessary. The Department anticipates some changes to local drainage along the potential branch rail line and would design the rail line to accommodate existing drainage patterns.

Soils in and adjacent to the corridor would be disturbed on approximately 9.3 square kilometers (2,300 acres) of land during construction of a railroad. Impacts to soils in the corridor, including its variations [6.5 square kilometers (1,600 acres)], would be small, but could occur throughout construction. However, several soil characteristics could influence construction activities and the amount of area disturbed. Soils susceptible to wind erosion occur along much of the corridor and its variations (see Chapter 3, Section 3.2.2.1.4.). Soils considered to be highly susceptible to water erosion and having poor stability characteristics are also present, but along much smaller portions of the corridor. Disturbance of erodible soils could lead to increased silt loads in water courses or increased soil transport by wind. Erosion control during construction and revegetation, or other means of soil stabilization after construction, would minimize these concerns. The presence of soils with poor (that is, high) shrink-swell and stability characteristics could influence the amount of area disturbed by construction if soils from outside areas had to be brought in for replacement or mixing with native soil. The source of suitable fill material and the land area that would be disturbed in obtaining the material is presently unknown, so the potential for impacts to soils and biological resources associated with the borrow areas cannot be determined.

Soils classified as unstable fill also occur along portions of the Jean corridor, including its variations. The amount of land disturbance in the corridor for stabilization of a rail line and outside the corridor at the source of fill material could increase due to the presence of these soils. The source of suitable fill material and the land area that would be disturbed in obtaining the material is unknown at present, so DOE cannot determine the potential for impacts to soils and biological resources associated with the borrow areas.

As stated in Chapter 3, Section 3.2.2.1.4, variations identified for the Jean Corridor could avoid some biological resources, as listed in Table 6-64.

6.3.2.2.4.4 Jean Rail Cultural Resources

Construction. The Jean Corridor passes through the Goodsprings and Johnnie historic mining districts, and intersects the historic Yellow Pine Mining Company Railroad grade. In the southern part of the Pahrump Valley, the corridor, including the Wilson Pass and Stateline Options, crosses the Old Spanish Trail, which is under consideration for designation as a National Historic Trail. Based on Bureau of Land Management resource planning, both the Goodsprings and Pahrump Valleys are expected to contain fairly high numbers of potentially significant archaeological and historic sites. Precise impacts from rail line construction activities would be identified after completion of a cultural resource study of the corridor.

Table 6-64. Biological resources avoided by Jean Corridor variations.[a]

	Occurrence of resource			
	For unvaried segment of corridor		Occurrence avoided by variation	
Alignment variation resource	In corridor[b]	Within 5 km[c]	In corridor	Within 5 km
Stateline Pass Variation				
Sensitive species				
Allen's big-eared bat	0	1	0	1
Desert bearpoppy	0	3	0	1
Fringed myotis	0	1	0	1
Gila monster	0	1	0	1
Long-legged myotis	0	1	0	1
Pinto beardtongue	2	18	2	17
Sheep fleabane	0	1	0	1
Spring Mountain milkvetch	0	2	0	2
Townsend's big-eared bat	0	1	0	1
White-margined beardtongue	0	5	0	3
Yuma myotis	0	1	0	1
Game habitat				
Bighorn sheep–crucial	1	1	1	1
Bighorn sheep–migration corridor	2	0	1	0
Bighorn sheep-winter	1	7	0	3
Chukar–crucial	1	0	1	0
Mule deer–summer crucial	0	2	0	1
Mule deer–winter	2	2	1	1
Quail–crucial	3	4	1	3
Springs or groups of springs	0	11	0	5
Herd Management Units	3	0	2	0

a. Variations listed are those that would result in the avoidance of biological resources along the corridor.
b. In the corridor [or springs within 400 meters (0.25 mile)], but avoided by the corridor variation.
c. Within 5 kilometers (3 miles) of the corridor, but more than 5 kilometers from the corridor variation.

Archaeological site file searches for the Jean Corridor and its variations (Appendix J, Section J.3.1.2) revealed six recorded archaeological sites, four of which have been evaluated as being not eligible for the *National Register of Historic Places.*

There are no known Native American resources in this corridor, although the corridor passes through the traditional homelands of the Pahrump Paiute Band. In the early historic period, there were several village sites in the northern area at the base of the Spring Mountains; a branch rail line could affect some of these locations. Pending completion of field ethnographic studies, there could be other sites or resources of importance to Native Americans along this corridor that rail construction activities could affect.

Operations. As stated in Section 6.3.2.1, additional impacts to these resources during the operation of the branch rail line would be unlikely.

6.3.2.2.4.5 Jean Rail Occupational and Public Health and Safety

Construction. Industrial safety impacts on workers from the construction and use of the Jean branch rail line would be small (Table 6-65). The analysis evaluated the potential for impacts in terms of total reportable cases of injury, lost workday cases, and fatalities to workers from construction and operation activities. The analysis also evaluated traffic fatality impacts that would occur during the moving of equipment and materials for construction, worker commutes to and from construction sites, and transport of water to construction sites if wells were not available. Table 6-66 lists these results.

Operations. Incident-free radiological impacts would occur during the routine transportation of spent nuclear fuel and high-level radioactive waste in using the Jean Corridor. Table 6-67 lists the incident-free

Table 6-65. Impacts to workers from industrial hazards during rail construction and operations for the Jean Corridor.

Group and industrial hazard category	Construction[a]	Operations[b]
Involved workers		
Total recordable cases[c]	67	73
Lost workday cases	33	40
Fatalities	0.09	0.20
Noninvolved workers		
Total recordable cases	4.0	4.1
Lost workday cases	1.5	1.5
Fatalities	0.004	0.004
Totals		
Total recordable cases	71	77
Lost workday cases	35	41
Fatalities	0.10	0.20

a. Totals for 43 months for construction.
b. Totals for 24 years for operations.
c. Total recordable cases includes injury and illness.

impacts, which include transportation along the corridor and along railways in Nevada leading to a Jean branch line. The table includes the impacts of 1,079 legal-weight truck shipments from commercial sites that would not have the capability to load rail casks while operational.

6.3.2.2.4.6 Jean Rail Socioeconomics

The following paragraphs discuss potential socioeconomic impacts associated with the construction and operation of a branch rail line in the Jean Corridor.

Construction. The length of the Jean Corridor, 181 kilometers (112 miles), is the principal factor that would determine the number of workers required to construct a branch rail line. The construction of a branch rail line in this corridor would require workers laboring approximately 1.7 million hours or 855 worker years over a 43-month construction period. The workers would be temporarily housed in two construction camps (DIRS 154822-CRWMS M&O 1998, all).

Table 6-66. Estimated number of fatalities from construction material delivery vehicles and construction and operations worker commuting traffic for the Jean Corridor.

Jean	Kilometers[a]	Traffic fatalities	Emissions fatalities
Construction[b]			
Materials delivery vehicles	10,000,000	0.2	0.02
Commuting workers	52,000,000	0.5	0.07
Subtotals	*62,000,000*	*0.7*	*0.09*
Operations[c]			
Commuting workers	52,000,000	0.5	0.07
Totals	***110,000,000***	***1.2***	***0.16***

a. To convert kilometers to miles, multiply by 0.62137.
b. Totals for 43 months for construction.
c. Totals for 24 years for operations.

Table 6-67. Health impacts from incident-free Nevada transportation for the Jean Corridor implementing alternative.[a]

Category	Legal-weight truck shipments	Rail shipments	Totals[b]
Involved workers			
Collective dose (person-rem)	38	720	760
Estimated latent cancer fatalities	0.02	0.29	0.3
Public			
Collective dose (person-rem)	7	150	160
Estimated latent cancer fatalities	0.003	0.08	0.08
Estimated vehicle emission-related fatalities	0.002	0.08	0.08

a. Impacts are totals for 24 years.
b. Totals might differ from sums of values due to rounding.

Employment

DOE anticipates that the total (direct and indirect) employment in the region of influence attributable to rail line construction would peak in 2007 at about 526 jobs. DOE anticipates that 92 percent or 483 workers, would come from Clark County. Approximately 42 workers would come from Nye County and 1 from Lincoln County. The increase in employment represents less than 1 percent of the baseline for Clark, Nye, and Lincoln Counties. Employment of Jean Corridor construction workers and some indirect support workers would end in 2009. As a result, the projected total growth (2009 to 2010) of 15,240 jobs in the region of influence would be reduced by 490. The expected addition of 14,886 jobs in Clark County would be reduced by 449, and the expected growth of 330 jobs in Nye County would be reduced by 41. The expected growth of 24 jobs in Lincoln County would be unaffected. DOE anticipates that project-related workers not moving to Jean Corridor operational jobs would be absorbed in other work in the State. These changes in employment would represent less than 1 percent of the applicable baselines.

Population

Population increases in the region of influence attributable to the construction of a Jean branch rail line, which would lag behind increases in employment, would peak in 2009 at about 492 persons. DOE anticipates that approximately 449 would live in Clark County, 42 in Nye County, and 1 in Lincoln County. The increase in population would be less than 1 percent of each county's population baseline. Because the impacts to population in each county would be small and transient, impacts to schools or housing would be unlikely.

Economic Measures

The expected peak changes in the region of influence attributable to constructing a branch rail line in the Jean Corridor would be increases of about $15.2 million in real disposable income in 2009; about $25.7 million in Gross Regional Product in 2007; and about $1.6 million in State and local expenditures in 2009. More than 96 percent of the increases in real disposable income and Gross Regional Product and about 91 percent of the increase in State and local government expenditures would occur in Clark County. Most of the remainder of the increase would occur in Nye County. The impacts to Clark, Nye, and Lincoln Counties for each of these measures would be less than 1 percent for each county's applicable baseline. (Dollar values reported in this section are in 2001 dollars unless otherwise stated.)

Transition and Operations Period. A period of slightly slower employment growth would occur from 2010 to 2012, and then employment to operate a branch rail line would contribute to an increased rate of growth. Growth in employment in the region of influence during this transitional period would be approximately 15 fewer jobs annually than would occur without a rail line in the Jean Corridor. Clark County would experience all of the slower rate of growth. During this period, the Clark County employment baseline would be about 1 million jobs. Nye County would gain 1 job during this period. The Jean rail line would contribute to the growth in residential population throughout the transition period.

Employment and Population

Estimated direct employment for the operation of a branch rail line in the Jean Corridor would be 36 workers. The total increase in employment in the region of influence would average 54 jobs over the 24-year operation period (2010 to 2033). On average, 52 of these jobs would be in Clark County, 1 in Nye County, and none in Lincoln County. These increases represent less than 1 percent of the counties' employment baselines. An increase in the Clark and Nye County populations attributable to a Jean rail line would be about 208 individuals, 91 percent of whom would live in Clark County. The balance would live in Nye County. The impact to the baseline population in both counties would be less than 1 percent. Because the increase to the population baseline would be small, impacts to the school system or housing would be unlikely. There would be no change in employment or the number of residents in Lincoln County due to a Jean rail line.

Economic Measures

In the three-county region of influence the greatest increase in real disposable income above the baseline attributable to operations would occur in 2033, the last year of operation. This increase would be $4.3 million; the average increase in each of the 24 years of operation would be about $3.7 million. The increase in Gross Regional Product would average about $3.6 million. On average during rail line operations, changes in real disposable income would exceed changes in Gross Regional Product. Annual State and local government expenditures would average $722,000. Nearly all of the economic activity would occur in Clark County; virtually none would occur in Lincoln and Nye Counties. Annual impacts to real disposable income, Gross Regional Product, and State and local government expenditures from the operation of a branch rail line in the Jean Corridor would be less than 1 percent of the baseline for each county.

The results of the detailed analysis performed for the Jean Corridor driven by the corridor length are representative of the variations (options and alternates) listed in Appendix J, Section J.3.1.2. The lengths of the variations are similar to those listed in Table 6-60.

6.3.2.2.4.7 Jean Rail Noise and Vibration

The Wilson Pass and Stateline Pass Options in the southern portion of the Jean Corridor and the Pahrump Valley Alternate pass through mostly U.S. Government land set aside for use by DOE or managed by the Bureau of Land Management. They also cross a small amount of private land. The Wilson Pass Option passes the communities of Amargosa Valley, Goodsprings, Jean, and Pahrump. In addition, the Stateline Pass Option passes the small communities of Sandy Valley and Primm. The smaller rural communities associated with the Jean Corridor and its variations (Appendix J, Section J.3.1.2) would be likely to experience noise levels from the operation of trains in excess of the benchmark nighttime noise level of 50 dBA, but not the daytime residential noise level of 60 dBA (Table 6-68). Jean and Primm are principally commercial business communities consisting of gaming industry, retail, and Primm businesses. In addition, the potential for growth and development in the Jean and Pahrump areas could place residents and businesses close to a Jean branch rail line, leading to noise impacts from both construction and operations.

Table 6-68. Estimated propagation of noise (dBA) from the operation of a waste transport train with two locomotives in communities near the Jean Corridor.

Corridor/community	Distance (kilometers)[a]	Noise (dBA)[b]
Wilson Pass Option		
Jean	1.6	48
Goodsprings	1.2	54
Pahrump	2.0	43
Amargosa Valley	1.0	57
Stateline Pass Option		
Stateline	1.6	48
Sandy Valley	1.0	57
Goodsprings	1.2	54
Pahrump	2.0[c]	43
Amargosa Valley	1.0	57

a. To convert kilometers to miles, multiply by 0.62137.
b. Estimated values do not include noise loss due to interactions with the ground that could account for decreases in estimated noise levels of from 10 to 20 dBA at 100 meters (33 feet) from the tracks.
c. Noise estimates at distances greater than 2 kilometers (1.2 miles) have large uncertainty.

Noise impacts for the Jean Corridor would be limited because, at distances more than 0.8 kilometer (0.5 mile) daytime noise from trains would be below noise standards for residential areas (60 dBA) and because few residents and businesses are this close to the corridor. Nonetheless, because a Jean branch rail line could pass near some communities, there would be a potential for noise impacts from both

construction and operations. As discussed in Section 6.3.2.1, in areas where a branch rail line or variation passed near a community, transports could be limited to the extent necessary to ensure that noise was below levels listed as accepted noise hazards.

The estimated population that would reside within 2 kilometers (1.3 miles) of the Jean Corridor in 2035 is about 1,300 persons.

Vibration. The Jean Corridor and its variations would be distant [more than 200 meters (660 feet)] from historic structures and buildings. There are no known ruins of cultural significance along the corridor. Therefore, vibration impacts to structures would be unlikely. The small number of trips (three per day) and the small train size would result in low levels of rail-induced ground vibration.

6.3.2.2.4.8 Jean Rail Aesthetics

The Wilson Pass Option of the Jean Corridor would pass through Class II lands in the Goodsprings Valley and Spring Mountains. The objective of Bureau of Land Management Visual Resource Class II lands is to preserve the existing character of the landscape. According to the Bureau, the level of changes to the landscape should be low. Management activities could be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture of the characteristic landscape. Because of this, the building of a rail line in the Wilson Pass Option probably would require more stringent construction practices to limit visual resource impacts. Although impacts due to construction activities would be short term, visual impacts to recreational land use in this area would be likely. If DOE selected this option, additional consultation with the Bureau would be necessary to address aesthetic impacts.

The operation of a branch rail line through the Class II visual resource lands in the vicinity of Wilson Pass in the Spring Mountains would draw attention to the rail line and degrade the aesthetics of the area, thereby reducing the quality of recreational use of the area.

6.3.2.2.4.9 Jean Rail Utilities, Energy, and Materials

Table 6-69 lists the use of fossil fuels and other materials in the construction of a Jean branch rail line.

Table 6-69. Construction utilities, energy, and materials for a Jean branch rail line.

Route	Length (kilometers)[a]	Diesel fuel use (million liters)[b]	Gasoline use (thousand liters)	Steel (thousand metric tons)[c]	Concrete (thousand metric tons)
Jean	180 - 200	26 - 30	500 - 570	26 - 29	150 - 170

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. To convert metric tons to tons, multiply by 1.1023.

6.3.2.2.5 *Valley Modified Corridor Implementing Alternative*

The Valley Modified Corridor originates near the existing Apex rail siding off the Union Pacific mainline railroad. It travels northwest passing north of the City of Las Vegas, north of the Town of Indian Springs, parallel to U.S. 95 before entering the southwest corner of the Nevada Test Site and reaching the Yucca Mountain site. The Valley Modified Corridor is about 159 kilometers (98 miles) long from its link with the Union Pacific line to the site. Variations of the route range from 157 to 163 kilometers (98 to 101 miles). Figure 6-19 shows this corridor along with possible variations identified by engineering studies (DIRS 154960-CRWMS M&O 1998, all). The variations provide flexibility in addressing engineering, land-use, or environmental resource issues that could arise in a future, more detailed survey along the corridor. This section addresses impacts that would occur along the corridor shown in Figure 6-19. With the exception of differences identified in Appendix J, Section J.3.1.2, the impacts would be generally the